Editorial

IN this issue, we have featured the first of a series of radio receivers designed especially for home constructors with a moderate knowledge of radio who would like to build their own.

In order to simplify the task, we have taken great care to see that the circuit and layout are simple, and that the clearest of instructions are given to ensure success when the power is switched on.

Finally, so that the radio dealer can easily supply your needs, and so that you know exactly what you want when you go into his shop, we have prepared the component list in the form of a Kitset. Because all radio dealers who read our magazine—and I'm sure there are very few who do not—will have this information, it should only be necessary for you to ask for a Radio and Hobbies Kit No. 1, and he will know exactly what you want. If he prefers, he can have the parts ready assembled in a box, so that you can take everything away in one parcel.

The Kitset idea is not new. On the contrary, a few years ago it was exceedingly popular. Unfortunately the last war period completely disorganised the radio trade, and the idea of being able to obtain every part required for a Kitset, apart from anything else, was often a sheer impossibility.

Today, however, with the exception of normal temporary shortages virtually everything needed for building a receiver can be obtained quite readily, and there is no reason why Kitsets should not become popular once again.

Another and important reason we have for commencing what we intend to be a series of Kitsets is the duty we owe to our readers who are also beginners or near beginners. As I have pointed out on other occasions, radio is now such a big subject to cover that, in trying to keep abreast of what goes on, even we often tend to overlook the needs of those to whom set building is a new and fascinating thing. If we cannot be blamed for this, at least we can do what we can when the opportunity arises, to simplify radio as much as possible so that almost anyone with a mechanical turn of mind can successfully make his own.

For these reasons, therefore, we shall from time to time issue further Kitsets—in the main, straightforward designs simplified in their construction and presentation, so that your potential mistakes are reduced to an absolute minimum.

John Moyle

RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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VOL. 12 No. 4

SUBSCRIPTION RATES

	C'wealth & New Guinea	N.Z.	Overseas British	Foreign
1 year	12/-	13/-	15/-	18/8
6 mths.	6/-	6/6	7/3	7/9

Published on the first Friday of each month by Associated Newspapers Ltd., 60-70 Elizabeth St., Sydney.

Phone — — — — — — B0333

OUR COVER PICTURE

A beautifully finished scale model ship is given a trial run at the Ashfield headquarters of the Sydney Society of Model Engineers. Speed trials are conducted on this same pond. For full story, see page four.

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STANDARD FERGUSON RANGE

POWER & VIBRATOR TRANSFORMERS

Code	A.C.	Vib.				Retail
PF 122	240	6	220	40	6.3V @ 2A	33/6
PF 125	240	6	250	60	6.3V @ 2A	43/-
PF 119	240	6	325	125	6.3V @ 4A	62/-
PF 182	240	12	200	40	12.6V CT @ 1A	33/6
PF 126	240	12	250	60	12.6V CT @ 1A	47/6
PF 146	200,30,40	12	325	150	12.6V CT @ 2.5A	67/-

FILTER CHOKES

Code	Induct	D.C. Res.	M.A.	Retail
CF 100	50	1900	10	18/-
CF 101	30	870	25	18/-
CF 102	15	300	60	12/-
CF 103	30	420	60	26/-
CF 104	30	580	75	31/-
CF 105	15	250	80	24/-
CF 106	12	200	100	24/8
CF 107	30	360	100	34/8
CF 108	12	135	150	35/-
CF 109	20	225	150	37/8
CF 110	12	100	200	43/8
CF 111	16	165	200	45/10
CF 112	10	70	250	46/2

SPECIAL CHOKES

CF 113	.5	70	250		
	20		50	Swinging choke	50/6
CF 114	1.1	23	375	Ballast choke	24/-
CF 115	.017	.6	2 amps	L.T. choke	10/-

OUTPUT TRANSFORMER TO VOICE COIL

Full Frequency Range (30-15000)

Code No.	Pri. Imped.	Sec. Imped.	Watts	Retail
OP24	5000 SE	8.4, 2.1, with feed back	5	44/10
OP23	3250 SE	12.5, 8.4, 2.1	10	65/1
OP19A	5000 PP	12.5, 8.4, 2.3	15	102/10
OP51	4500 PP	15.5, 12.5, 8.6, 2.8, 2	20	36/9
OP63	10000 PP	15, 3.75	15	100/-
OP64	10000 PP	12.5, 3.125	15	100/-
OP65	10000 PP	8.4, 2.1	15	100/-

OUTPUT TRANSFORMER TO VOICE COIL

Special Full Frequency (20-30,000)

OP25/40	10000 PP	40, 10	15	130/-
OP25/16	10000 PP	16, 4	15	130/-
OP25/15	10000 PP	15, 3.75	15	130/-
OP25/12	10000 PP	12, 3	15	130/-
OP25/10	10000 PP	10, 2.5	15	130/-
OP25/8.4	10000 PP	8.4, 2.1	15	130/-
OP66	5000 PP	8.4, 3.7	15	130/-
OP67	5000 PP	15, 6.5	15	130/-

OUTPUT TRANSFORMER TO LINE—

Full Freq. Range.

OP22	3250 SE	500, 125, 8.3	10	65/1
OP19b	5000 PP	500, 250, 125	15	102/10
OP21	8000 PP	500, 250, 125	15	82/10
OP62	10000 PP	500, 125	15	100/-

OUTPUT TRANSFORMER TO LINE—

Special Full Freq. Range

OP25/500	10000 PP	500, 125	15	130/-
OP25/250	10000 PP	250, 62.5	15	130/-

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	MA	Buffer Full Sec.		Retail
VT 100	32	200	40	.005	Sync.	27/-
VT 101	6	90	15	.008	"	19/6
VT 102	6	150	25	.005	"	23/10
VT 103	6	200	50	.005	"	25/-
VT 104	6	250	60	.005	"	37/-
VT 105	12	250	60	.005	"	37/-
VT 106	6	300	75	.008	"	52/-
VT 107	6	250	60	.005	Sync. Low Rad.	30/6
VT 108	12	90	15	.008	Sync.	21/8
VT 109	24	90	15	.008	"	23/8
VT 110	12	150	25	.005	"	23/10
VT 111	24	150	25	.005	"	26/6
VT 112	12	200	50	.005	"	25/-
VT 113	24	200	50	.005	"	26/6
VT 114	12	300	75	.008	"	54/2
VT 115	24	300	75	.008	"	55/6
VT 116	24	250	60	.005	"	30/-
VT 117	12	250	60	.005	Non Sync. Low Rad.	31/-
VT 119	32	150	25	.005	Sync.	25/6
VT 121	6	180	30	.005	"	25/4
VT 122	6	400	50	.005	"	50/-
VT 123	12	320	125	.005	Sync.	63/3
VT 124	32	250	60	.005	"	30/-
VT 127	6	200	50	.005	Sync. Low Rad.	29/8
VT 128	12	250	60	.005	Sync. Low Rad.	38/-

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Retail
PF 185	240	150	50	6.3V @ 2A	24/-
PF 106	240	325	45	6.3V @ 2A, 5V @ 2A	30/-
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	30/-
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	34/-
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34/-
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	46/-
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	46/-
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	56/-
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	66/-
PF 174	200,30,40	285	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	60/-
PF 175	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	70/-
PF 173	200,30,40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	110/-
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	111/-
PF 171	200,30,40	385	250	6.3CT @ 4A, 6.3 @ 3A, 5V @ 3A	144/-

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	
MT111	500	12.5, 8, 2.3	10	36/9
MT100	600	4, 3	15	36/9
MT101	500	15	15	36/9
MT124	600, 500	4, 3, 2.7, 2.3, 2	25	66/-
MT125	600, 500	15, 12.5, 8.4, 6.5	25	66/-

MODULATION TRANSFORMERS

MT118	8000, 6000 PP	10000, 7000, 5000	25	85/-
MT119	8000, 6600, 3800 PP	1000, 7500, 6500, 5500, 4500, 3500.	50	111/-
MT120	500 to 20000 in steps.	500 to 30000 in steps.	50	200/-
MT121	500 to 20000 in steps.	500 to 30000 in steps.	125	276/-

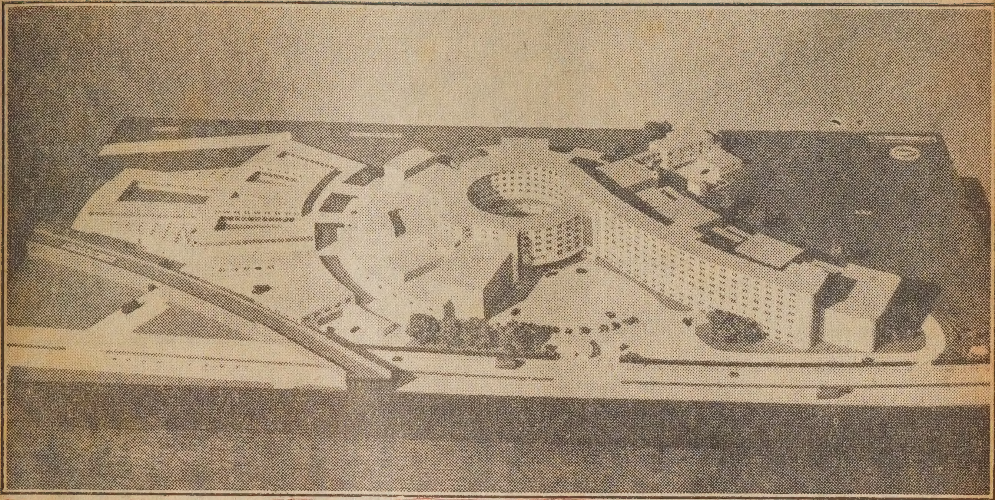
Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1	5000, 2500 SE	12.5. 8. 2.3	10	39/10
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	45/8
OP39	5000, 2500 SE	15	10	39/10
OP33	5000, 2500 SE	5, 2.7	10	39/10
OP41	5500 SE	3.7	10	46/-
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.3	10	36/9
OP2	5000 PP	12.5. 8. 2.3	15	65/1
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP3	6600 PP	12.5, 8, 2.3	15	65/1
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP4	10000 PP	12.5. 8. 2.3	15	65/1
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/1
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	76/2
OP59	10000, 6600, 5000 PP	15 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/8
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	32	116/8

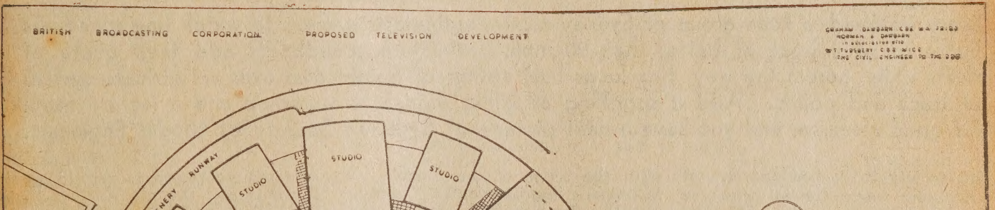
OUTPUT TRANFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1A	5000, 2500 SE	500	10	39/10
OP44	5000, 2500 PP	500, 250, 125	10	47/-
OP34	5000 PP	600, 300, 200, 150, 130, 100 75, 50	15	81/4
OP6	5000 PP	500, 250, 125	15	65/1
OP7	6600 PP	500, 250, 125	15	65/1
OP50	8000 PP	600, 300, 120, 60, 30	15	126/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP		25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140, 70.	32	[illegible]
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP18	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25, 10, 5, 2	60	133/8
OP37	6400 PP	500, 250, 125	80	150/8
OP49	8800, 6000 PP	500	105	210/-
OP20	11600, 8400 PP	500, 250, 125	150	276/-

T.V. IN BRITAIN'S RADIO CITY



Television will have the first look-in when Britain's Radio City, estimated to cost between £4,000,000 and £5,000,000, rises on the White City exhibition site. The buildings cover 13 acres. They will be occupied in gradual stages. Television will take over the first half. In the model above it is the circular ring and buildings to the left of that. The use of the remainder has yet to be decided.


BRITISH BROADCASTING CORPORATION PROPOSED TELEVISION DEVELOPMENT
GRAHAM DAWBARN CBE MA FRIBA
NORMAN & DAWBARN
in association with
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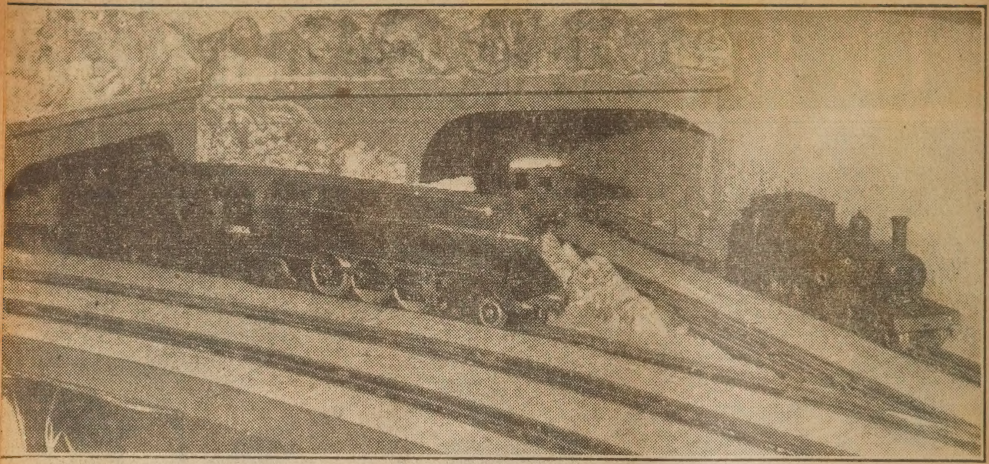
THE CIVIL ENGINEER TO THE BBC
SCENERY RUNWAY
STUDIO
STUDIO
STUDIO
STUDIO
ROOMS
ING
DRESS
OPEN COURT
NORTH
EXTENSION
ENTRANCE
STUDIO
STUDIO
STUDIO
SCENERY RUNWAY
0
100
200
SCALE IN FEET

The first block is expected to be ready by the end of 1952. It will be used as a scenery block to serve the new television studios at Shepherds Bush. Subsequent blocks will house television studios, dressing rooms and a canteen to relieve the congestion at Alexandra Palace, and finally replace this building when the B.B.C's lease expires in 1956.



Part of the "O" gauge railway system operated by the society. The electrically-driven models are of trains in current use in NSW. In the foreground is the streamlined C-38 express loco.

MECHANICS IN MINIATURE

Every weekend, a keen group of Sydney model enthusiasts gathers to watch tiny speedcars hurtle round a track at better than 90 mph. Miniature speedboats add their quota of thrills while, across the way, tiny locos haul strings of freight cars over an intricate system of track and points. Add a sprinkling of other models, a workshop and a lecture room for good measure, and you have a neat picture of Sydney's Society of Model Engineers.

by Maurice Findlay

THE society, with headquarters at Ashfield, caters for all who are nterested in model engineering. Age or profession form no barrier to membership. All that is required is that members share in the common interest in models. Active members of the society range from doctors, dentists, bank managers, office workers and shop assistants to professional toolmakers and mechanical engineers.

One of the features of the club is that men of otherwise widely different training are given the opportunity to share their knowledge on the basis of a common interest.

EARLY MEETINGS

The beginnings of the present organisation were made in 1908 by a number of enthusiastic lads who made model steam locomotives, stationary steam engines, and who, even in those early days, experimented with model flying machines. It was then called the Summer Hill Society of Model and Experimental Engineers.

The lads made a habit of meeting to display models and discuss technical improvements and, as time went on, the membership grew, along with the scope of the models and technical improvements. Subsequently, the society moved to Ashfield, where it has remained ever since and the name was changed to its present form.

The forty-second anniversary meeting of the society was held recently and four of the foundation members were present, including Mr. Fred Steward, who is still an active member.

Activities of the society at the moment are many and varied, but great interest is shown in both the model racing boats and cars and railway systems, both steam and electric. Most members are interested in all of the club's activities, though, naturally, they each have a subject in which they tend to specialise.

The miniature car section of the society has a large following and weekly speed trials are held. The cars must conform to certain specifications and the aim is to achieve the highest speed from the tiny cars and at the same time certain the appearance and characteristics of full-sized cars.

Experimental cars which do not resemble full-sized cars must be entered in a special section reserved for them.

Speeds approaching 100 mph are regularly realised and one car has reached 104 mph on the society's test track.

The cars are about 18 inches long and powered by motors having a capacity of only 10 cc, which pays tribute to the skill and patience of the owners, who spend many hours adjusting them for peak performance.

FUEL PROBLEMS

The fuel mixture must be adjusted to within very fine limits as also must the ignition timing. So critical are the adjustments that changes in temperature and humidity may have drastic effects on the performance of the cars.

Car owners talk about fuels like methyl-alcohol and nitro-methane, and a great deal of time is consumed in experimenting along these lines. The society is fortunate in having the co-operation of large oil com-

---

• **Secretary—Mr. Ray Steward, 190 Parramatta Road, Ashfield, NSW.**

panies in this matter and, where special fuels are required for experimental purposes, they can usually be obtained.

The tiny two-stroke engines run at something like 20,000 revs. per minute—almost a fantastic speed. The result is ear shattering in the vicinity of the track and, from a distance, the cars sound like a gigantic bee.

Ignition power is usually obtained from a battery connected to the car through the tether cable, although some of the cars carry their own ignition batteries. The wheels work at about 9000 rpm and are connected to the motor via a differential gearing system with a ratio of something between 1.5: 1 and 2:1. At this speed even the tiny pneumatic tyres become enlarged due to the centrifugal force acting on them.

TEST TRACK

Cars are tested on a circular concrete track. They are held to a centre post by a strong tether cable the length of which is carefully adjusted so that the pitch circle diameter described by the cars is 52' 6". Eight complete laps are timed when the cars are tested over a ¼ mile run or 32 laps for a full mile.

Special arrangements for timing the cars are made so that the official figures quoted by the society are very accurate. Club members have constructed an electronic timing device which obtains impulses from a contacter worked by the tether cable and speed figures are available within a few seconds of a car finishing its run.

Even the effect of strength in the tether cable is taken into account in the final figure.

The tether cable is an important item from the safety point of view. A car weighing 7 pounds and travelling at 100 mph would become a lethal missile if the tether cable were to break. Members of the Society are appointed to make frequent inspections of the tether cable and the cars themselves and no compromises are permitted where safety is concerned. A steel safety fence has been erected around the car track as an additional precaution. To date, no cases of cars coming adrift are on record.

MOSTLY HOME MADE

A few enthusiasts have bought cars but many are completely home made even to the engine. A complete car in running order is valued at from £60 to £70 and the attention given them by enthusiastic owners would more than do justice to a full sized racing car.

Equal pride in workmanship is shown by members of the Society who specialise in model speedboats. As with the cars, the aim is to attain the maximum speed within the limitations imposed by club rules.

Most of the boats are raced in the 1 metre class and must be less than 1 metre in length. Single cylinder internal combustion engines with a capacity of 30cc are usually employed and a speed of 45 mph has been officially timed with a boat owned by Mr. Frank Cooper.

A flash steam boat owned by the late Mr. Ron Cowan achieved a speed of almost 50 mph in 1936 and the performance has not yet been bettered for this type of boat. It stands as a world's record. The engine was a two cylinder piston-valve type, but the boiler consisted of 45 feet of steel tubing which was fired by a pair of blow lamps.

Improvements to boat permances are constantly being made, especially to petrol driven types, in which most members place their faith. As with the cars, fuels are under constant revision but, in addition, hull and propeller designs are major considerations.

The hulls are generally made from wood and beautifully finished glasslike surface which offers t least friction to the water.

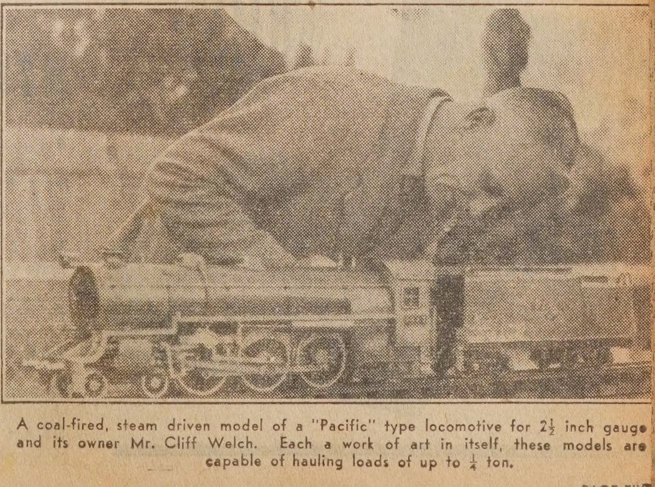
The 30cc engines are usually the single cylinder type, 4 stroke a with overhead valves. Two blad propellers about 3 inches in diame and with about 45 degrees pitch a used. Stainless steel is used to ma the blades which have thin razor-li edges.

Power loss due to propeller sli page is a major problem and mu thought is being given to its soluti Apart from theoretical specificatio the propellor must be strong enou to stand the terrific strains impos upon it. The boat men therefore ne a knowledge of metallurgy in ad tion to hydrodynamics.

Final adjustments to the boat a

MODEL CAR BEGINS A TEST RU

Mr. Ron Sinclair launches his model car on a run in which it will probably excee 90 mph. Since this picture was taken, further development in the launchin technique has taken place.



A coal-fired, steam driven model of a "Pacific" type locomotive for 2½ inch gauge and its owner Mr. Cliff Welch. Each a work of art in itself, these models are capable of hauling loads of up to ¼ ton.

YOU CAN
TAKE YOUR RECORDING STUDIO WITH YOU

Yes, you can . . . when you own an R33 unit. The R33 portable recorder and playback unit makes commercial standard recordings for you in offices, factories, halls, theatres and homes . . . just about everywhere they're needed!

ONLY THE BRS R33 RECORDER AND PLAYBACK UNIT OFFERS THESE ADVANTAGES

33 has two recording and ayback speeds — 78 and ⅓ r.p.m. R33 features a ngle cutting head, which erforms both cutting and ayback operations — plays dinary commercial record- gs, too! R33 cuts records, high quality, power and ne up to 12 in. in diameter. he amplifier is of original d progressive design. It as been built by engineers r engineers and men who cognise superior technical kill in both fundamentals and details. By these means, and the inclusion of negative feedback, high quality of sound essential to the making of good recording has been achieved. A 5 position control switch provides instantaneous change from any of the 5 services to any other. (Recording from mike, to recording from another source, etc.)

What's more, high quality but inexpensive 'BRS' blanks are readily available.

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made before the start of each run with the propeller out of the water. Then, before the boat is launched, a self opening throttle is brought into operation which allows the boat to gather some speed before full power is applied to the propeller. If this were not done, there would be a good chance of the boat being wrecked as the screaming propeller hit the water.

Both trials are made on a specially constructed concrete pond, 68 feet in diameter. A tether cable is used to hold them on course in a similar manner to the cars. Although the working speeds are somewhat lower than attained by the cars, the boats are comparatively heavy and very thorough safety precautions are insisted upon by Society's officials. Tether cables, anchor points, and boat parts must be in first-class condition before a high speed run is permitted.

Emergency stops can be made when required, by means of an ignition switch, connected to a steel rod projecting above the boat.

MODEL RAILWAY

While the boat and car enthusiast members of the Society concentrate on performance figures, others find pleasure in constructing and operating perfect miniature reproductions of railway locomotives and stationary engines.

Two main schools of thought with regard to model railway system exist within the Society. In the case of the smaller scale, known as "O" Gauge, each foot of a full-sized train is scaled down to 7 mm. The distance between the rails is 1¼ inches.

Electric motors are used to power the trains which operate from 24 volts direct current. The power is usually obtained from a bank of accumulators, because the current is smooth and sudden, demands for current can easily be met when required.

"O" Gauge experts find that, with models of steam locomotives, best results are obtained when the driving motor is mounted in the engine tender. It is connected to the driving wheels of the locomotive by means of flexible drive cable which efficiently transmits the power, and at the same time allows the train to turn easily on curves.

We were shown the "O" Gauge layout by Mr. Ray Steward, who besides being an enthusiastic secretary of the Society, and "O" Gauge man, is a professional modelmaker, like his father.

FAMILY TRADITION

Mr. Fred Steward is one of the foundation members of the Society, and was its secretary between the years of 1910 and 1920. Footsteps of Father and Grandfather look like being followed by 3-year-old Sandy Steward, who has been able to operate an "O" Gauge layout since he was two years of age.

Supplies of parts and machined casting for "O" Gauge trains are readily available to club members. A complete locomotive can be made from parts for a cost of about £12 and is valued at over £30 when complete, and in working order.

Locomotives capable of hauling a man are made by the 2½ inch gauge enthusiasts. For this gauge, the equipment is built on a scale of ½ inch to each foot of a full-sized locomotive. The models are steam powered and perfect reproductions of the full-sized job down to such items as steam pressure gauges, headlights &c.

These model railway enthusiasts are not content to copy standard overseas plans, but prefer to model types which are current on NSW railways. Valve mechanism, oil and water pumps, springs and meters all work just as they do in the full-sized locos.

BOILER PRESSURES

Attention must be given to safety factors since the boilers work at pressures in the vicinity of 100lb per square inch. Complete tests are given the boilers before they are operated regularly.

Hundreds of hours of exacting work are required to put a 2½ inch gauge locomotive on the rails. Publicity officer for the Society, Mr. Lloyd Grono, showed us his locomotive and tender into which he had put four and a half years of exacting spare time work. He expects that it will take him another six months to complete.

Even the tiny screws must be mad by hand. Some of the parts requir special patterns and castings, not t mention involved machining whic would do credit to any professiona engineering man.

Technical advances are brought t the notice of Society members b means of lectures and films. Metallurgy, machining problems and glas technology are typical of the subject which have been treated.

FOR GOOD CAUSES

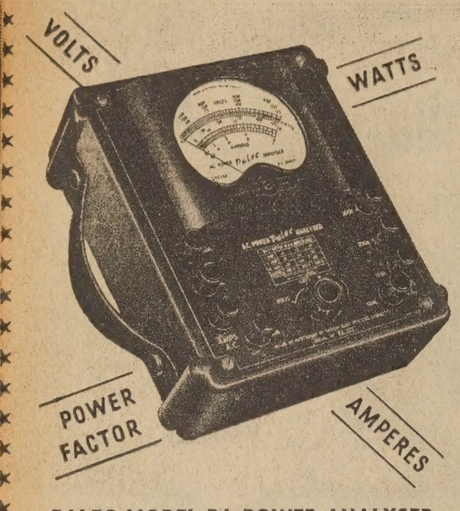
The Society makes a small charg for admission to the grounds eac Saturday afternoon and the mone is used to make improvements to th grounds. Five special exhibitio meetings are now held each year the entire proceeds being donated t hospitals and charities. As plans fo improvement are near completion i is hoped that even more money wil be raised for worthy causes. Th wives and mothers have a committe which takes an active part in th charitable activities by providin refreshments for visitors.

Similar clubs to the Sydne Society of Model Engineers are i existence in other States and overseas. Apart from providing an interesting leisure occupation they giv a fundamental knowledge of mechanics and allied subjects. Some o the world's greatest engineers hav received their first inspiration from such fascinating working models.

SPEED IS NOT SCALED DOWN

A 1 metre speedboat begins its trial run. The boats are masterpieces of streamlined efficiency and can skim over the water at speeds approaching 50 mph.

2 NEW PALEC STARS



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Model M.30—new 30-range multi-meter (superseding the famous model MCA)—is indispensable for modern radio and electrical technique.

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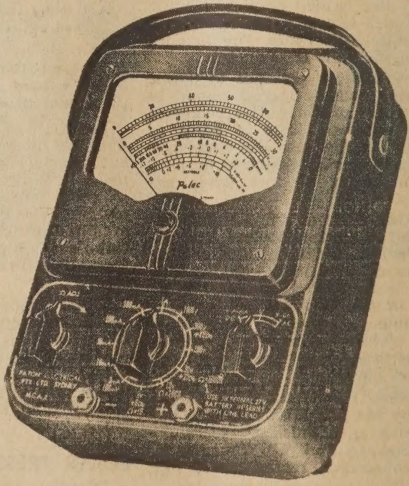
M.30 MULTIMETER



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WOMAN ENGINEER RECEIVES O.B.E.

Included in the latest King's Birthday Honors List is the name of Mrs. F. Violet McKenzie. Awarded the O.B.E. for voluntary services, Mrs McKenzie has trained thousands of men and women in all forms of signalling, both sound and visual. Her effort was a major contribution to the war effort and the honor bestowed upon her by the King is well deserved.

Mrs. F. Violet McKenzie, O B E, ASTC, MWES, MSE (Elec.)

EVEN since the war, Mrs. McKenzie has continued the work which, for her, has become an absorbing hobby. Hundreds of airline pilots and men of the merchant fleet come to her classes to benefit from her expert tuition.

Department of Civil Aviation and Board of Trade rules insist that pilots and ship's officers be trained to an approved standard in various forms of signalling. Before the school was started, these men found it very difficult to get the required training.

In most cases the men are required to have a knowlege of the morse code but sometimes it is necessary for them to be proficient in visual signalling as well. In addition, they must have a knowledge of the equipment they operate.

SIGNALS EXPERT

Mrs. McKenzie is an expert at both semaphore and Aldis lamp work, as well as morse code conveyed by sound, and is therefore in a position to offer the very best type of training.

Mrs. McKenzie's work owes much of its value to the fact that she takes a personal interest in every one of her pupils. If an individual needs a little extra help in one particular aspect of the work she is always willing to assist. On the other hand, if somebody is loafing on the job, "Mrs. Mac." as she is known to her pupils, will not hesitate to say so.

The value of her teaching methods is verified by the long list of successful candidates for Board of Trade and PMG examinations.

The Department of Civil Aviation have made aircraft equipment available to Mrs. McKenzie so that students can gain a knowlege of the equipment under practical working conditions. PMG examiners use this equipment to conduct the examinations.

Mrs. McKenzie emphasises the value of training under practical working conditions. She has installed an all wave receiver so that students can listen in to aircraft and ship's stations. They are able to hear and practise translating signals under exactly the same conditions as they will have to work later, when the safety of an aircraft or a ship may depend on their skill.

Through her work, which incidentally, does not bring her any financial gain, Mrs. McKenzie has made thousands of friends throughout the world. Airline pilots, ship's officers and servicemen who owe part of their training to her can be found in every corner of the globe.

When her O.B.E. was awarded recently, the first to ring and congratulate her was an airline pilot—one of her former pupils. Since then the telephone has hardly stopped ringing and the pile of congratulatory letters and telegrams on her desk has been rising ever higher and higher.

Apart from the hundreds of letters from her former pupils which include one from Mr. Howard Beale, the present Minister for Supply, and many other notable people, Mrs. McKenzie has received congratulary messages from the Prime Minister, Mr. Menzies, Lady Wakehurst and Vice-Admiral Collins. But she was particularly touched when a radio enthusiast, now an old gentleman almost 90 years of age, rang her to offer his congratulations.

Mrs. McKenzie is a friendly and unassuming little lady now in her fifties. When we asked her to tell us something about herself she replied that she was quite willing but she could not see that there was anything out of the ordinary!

But we learned that she gained a Diploma in Electrical Engineering at the Sydney Technical College in 1923. She is still the only woman in NSW, who is fully qualified as an Electrical Engineer. In 1925, she became interested in amateur experimenting and took out an amateur licence. She now holds the call sign VK2FV.

TELEVISION

Although she did operate a radio station under her amateur licence, she was more interested in experimenting than simply talking to other amateurs on the air. Even in those days when the electronic art was in its infancy she made some experiments in television.

About the same time she conducted a radio store in Sydney where she became known to thousands of "wireless" experimenters to whom she was ever ready with helpful information and advice about their hobby. It was also about this time that she met and married her hu band, another radio enthusiast.

In 1939, as a voluntary job and hobby, Mrs. McKenzie opened signals school to train girls for th Women's Emergency Signallin Corps. During the war, when th need for both men and wome trained in signalling became ver urgent, she and her assistants traine more than 12,000 men of the servic and 1000 girls in all forms of signa ling. As a mark of respect for he services in this regard Mrs. McKen zie was made an honorary Fligh Officer in the WAAAF.

WELL-KNOWN NAMES

The walls of her school in Clarenc Street are adorned with pictures hundreds of her former pupils an friends. Girls she taught during th war have even sent her pictures their husbands and babies.

Included in her collection ar pictures of Captain P. G. Taylor an Mr. Arthur Butler, who now runs large airline company. Her mo treasured picture is an autographe photograph of the great Professo Einstein with whom she correspond regularly.

One of her former pupils, who now flying with an airline, recentl brought her a didjeridoo, an Aus tralian aboriginal instrument, whic she sent on to the professor. He wa greatly interested but puzzled by th device which defied his efforts t make it produce an intelligible sound

Wherever in the world she may g Mrs. Mckenzie will always be abl to find friends.

The whole of Australia and man thousands of men and women i particular, owe a great debt to Mr Violet McKenzie and join with u in congratulating her on winning th O.B.E. Its motto "For God and th Empire" could not be in better hand

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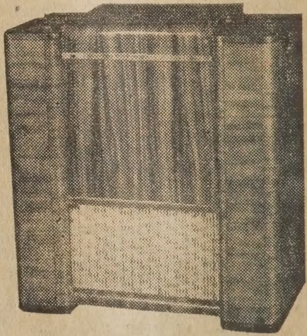

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CARS MUST CHANGE—PROF. LOW

Perhaps you've just spent £1000 on a new car. You polish its gleaming paintwork and boas to the neighbors about its performance, its smooth ride. According to Professor Low, you new car is just a makeshift contraption, full of mechanical contradictions. In 50 years' time people will laugh at its crudity.

CHANGES are certain. You will remember the story of the lazy boy and the steam engine. He had to open the inlet valve by pulling a string every time the piston reached dead centre, and he soon fixed up a lever to do his work. Mechanical valves had to come. It was obvious. The boy and string idea were too crude to last.

But today's design will be just as crude in the eyes of the future, and it is clear that certain characteristics common to nearly every "modern" car, will have to go. Yes, it is obvious, and the details, as the catalogues say, are "too numerous to mention." They are a matter not of prophecy but of commonsense.

Exactly the same circumstances apply to all other inventions, which are as much an affair of fashion as a hat.

The introduction of independent front wheel springing was an inevitable step the right direction. The process must continue, says Professor Low, to give complete independent suspension and a reduction of unsprung weight.

MOVING PICTURES

In the early days of the cinema most people preferred a magic lantern. But movement became necessary. Then sound, color, and now we search wildly for stereoscopy with all its "nearly impossible" techniques.

Every one of these changes was accurately foreseen and violently derided at the time.

Motor-cars are a first rate example, because they are collected from nearly every branch of science — from biology in tyres to mechanics, metallurgy, chemistry and modern physics. A conglomeration which remains both incomplete and startlingly poor, if we think upon the first principles.

Take carburettors and mix them with the otto-cycle. We want petrol-gas and air, but hesitate to use them because partly vaporised liquid helps to cool an engine. We need high compression, but have to reduce it for fear of pre-ignition.

RIDDLE OF R.P.M.

High engine speed is essential to prevent power from wasting itself into the radiator and exhaust pipe, yet we deliberately lower our rpm, for reasons of comfort, silence or gear losses.

Engines ought to be hot in order that heat may not be absorbed from the exploding gas. Yet, they m run cool or they are impossible lubricate.

Combustion should be rapid to sure fuel economy, yet slow to g us an engine that is pleasant to dr or cheap to manufacture.

Make petrol hot to prevent c densation, and then make it cold improve volumetric efficiency! is all very queer.

Anyone could foresee the sup charger being brought in to help that, in the fraction of a seco available to charge the cylind enough pressure was available to the mixture past a little valve. A it must be a relatively small val or its loading becomes impossi high.

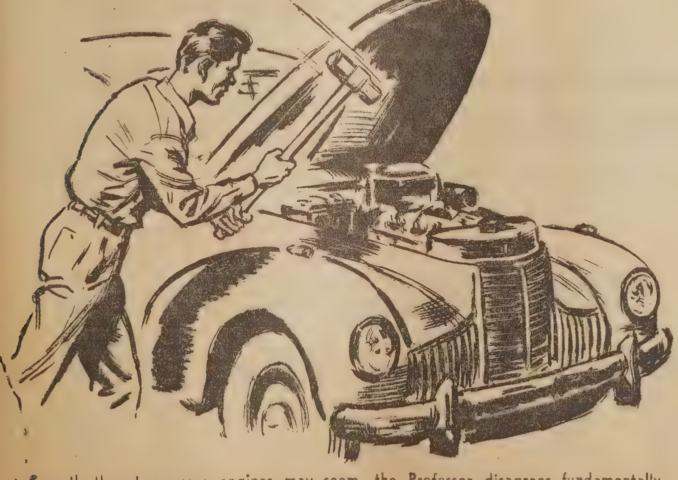
A NEW PASTIME

Hence my favorite form of amu ment: It is to stand near an idl bus engine, where fuel is metered a pump, to appreciate the joke bouncing springs, with valves wh never do as they are told, and to ten to the racket of it all. Just lis to a high speed engine, or slow do its movements—there are many them—by a high speed camera. becomes painfully clear that sor thing should be done about it.

I believe that in the far dist future, when the transmission electric energy becomes cheap or production so easy that waste d not matter, we shall have electr ally-run cars on the "Russian f tory" principle of induction.

Even electric storage may be p sible in our grandchild's day. meantime, reciprocating engines ca not last much longer.

At the moment turbine jet engin which might eventually give us ca cum-aircraft, appear impractical



Smooth though modern engines may seem, the Professor disagrees fundamentally with the operating principles.

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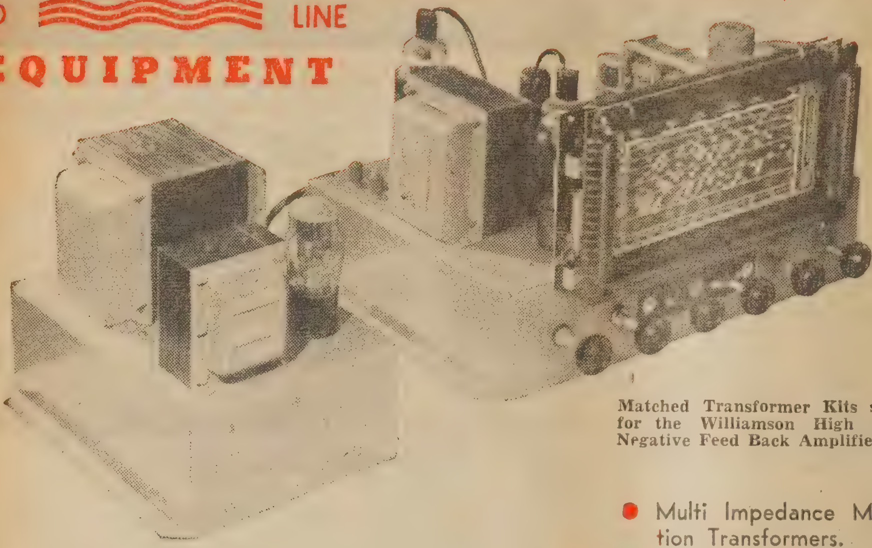

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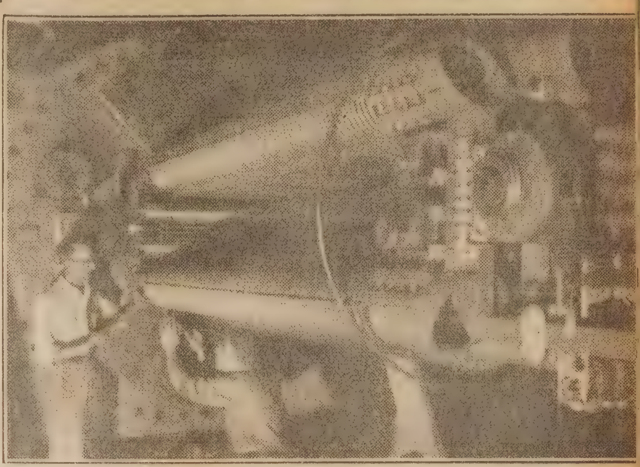
ELECTRIC "GUN" SHOOTS PROTON



General Electric Engineers are shown constructing one of several. devices fo nuclear study at the Brookhaven atomic research centre. Two long belts moving between the long tubes in the foreground will carry electrostatic charges to a aluminium sphere at the far end of the generator. The accumulated voltage wil accelerate protons through a tube on to a target where their reaction is studied

But so was fluorescent lighting for automobiles a few years ago.

It is less than 20 years since internal combustion turbines were jokes. I have made several. They were all failures, because if the metal ran hot it melted, and, if cooled, it poured useful heat down the cooling water drain pipe. But that has changed. Internal combustion engine turbines are running as power plants and on locos with great success, as the result of metallurgical progress.

Have you ever worked out the causes of rattle? Modern cars either rattle or waste power. Most large, comfortable vehicles are deliberately wasteful. A 7 hp motor will actually give as much power as one of 30 hp, if noise and fuss are neglected.

THOSE VALVES

Think of exhaust valves. Four of them, each with a 70lb spring and a load of perhaps 80lb gas pressure. It needs a pressure of far more than 100lb before each valve can be opened, and if you will imagine yourself at a fair watching a man swiping at an anvil with a hammer in an attempt to "ring the bell" you have some idea of what progress in automobile design has achieved.

Quite heavy pistons have to be stopped and started many times every minute when an engine is running at even 3000 rpm. This is a comfortable speed for the driver, but not for the big end which with connecting rod and piston on its back, suffers a loading of several tons per square inch—also many times per minute. One hundred times per second to be accurate.

It is because this sort of thing cannot go on that, irrespective of technical consideration, I am so certain reciprocating engines will not last another 50 years on cars.

I believe that turbines will come to our rescue and that, given half the time, labor and money spent upon making a 1000 cc. engine produce 50 hp at 8000 rpm, half the bad principles which have been made to work will leave us for ever.

Great economy is seldom pleasant, and it is "pleasantness" which sells most ordinary cars.

SPRINGING PROBLEMS

No need to labor the point. Look at your car and think of all that is happening as you drive at 60 mph. My illustration is not exaggerated. No engine can stand hammers for very long.

For our second case we have springing, which is not unlike that of a coach built to travel at 6 mph over battlefield roads. But our cars now have wheels hitting lumps and dents at speeds of 60 or 80 mph, and we have not proportionately reduced unsprung load.

It is the inertia of a heavy wheel and axle that causes wear, discomfort or breakage. Breakage we have cured by making the axle heavier and stronger until its response to a blow is so leisurely that the chassis rises with it. There is no time for the axle to move on its own.

Logically, if one wheel on a solid axle is hit up by a moving road, and it is more convenient to consider the problem in this way, the opposite wheel wants to move downwards. Either the car must move as a whole or the axle must be featherweight.

The only alternative is to get out and dig a hole for this opposite wheel to sink into every time its mate goes over a bump

This illustration is again not exaggerated, but few people seem to realise that split axles for both front and rear are certain to win the day. To say they do not last is no argument.

Since when have independent springs and split axles receive the concentrated attention devoted to the old-fashioned types which are "utility only" in the worst sense of that unpleasant phrase?

Almost 30 years ago, I wrote that gas turbines or even inductive transmission might one day prove useful on the road, and the laughter took quite a long time to die down. My opinion ,in conclusion, is certainly not altered by the appearance of the Boeing turboprop engine with dimensions of 42in. by 22in., a weight of 140lb, inclusive, of an initial gearbox, and a horse-power of 200. This in addition to a static thrust of 50lb from the exhaust.

CARS AND BOATS?

It is said that it might be useful for cars or boats, a suggestion which to me is far less humorous than any reciprocating power plant yet designed.

Perhaps, now that the British Ministry of Supply has mentioned the possibility of turbines for road transport, something may be done. However, I have only been writing about the importance of gas turbines for 20 years. It is therefore, too much to hope that anything will happen in England until contempt for inve tion has been fully demonstrated.

These are but a few of the thi which cross my mind on a bad ro when the hill is medium and the e gine's doing work to which it is r really suited. Internal combusti engines have no true flexibility, a are inherently unsuited to traction their present form.

Add to all this the alleged ne for reducing the number of car typ the call for standardisation or pr duction at any cost of efficiency a the legal control of design by eco omic politics. The result from aspect of imaginative progress is far to seek. It is a conclusion whi is being forced upon nearly eve branch of invention today.

Synthetic mica

SYNTHETIC MICA with essentia the same properties as natu mica, but able to withstand mu higher temperatures, has been cr stallised successfully by Dr. Herb Insley, Alvin Van Valkenburg, a Robert Pike, the National Bure of Standards announced last mon To allow the mica to form at atmo pheric pressure instead of und high pressure as it does in natu fluorine in the form of fluoro-si cates is used as a crystallising age The other components are like th often used to make glass-quar magnesite and bauxite. The ra mixture is melted in a platinu lined crucible in an electric furna at almost 1400 degrees C. **As** t furnace cools, mica crystals gr from a tiny seed at the bottom the crucible.

The largest crystals so far grow at the Bureau have a surface ar of four square inches, and have dielectric constant of about 6.3.

These young people are reacting, not to mere speed, but to the play of centrifugal force in the "Tumble Bug" at Sydney's Luna Park. A big proportion of amusement devices rely for their thrills on this important principle.

T'S THE SPIN THAT COUNTS

Whether or no you know the meaning of "Centrifugal Force" you will certainly recognise its application in everyday life. It supplies cream for your table and flings the muddy water from cycle tyres.

HE great forces of nature are very
useful to mankind. He has been
e to harness and make them work
him. In so doing man has pro-
led himself with the means of pro-
ess and raised himself to a higher
ndard of living.

Consider for a moment the tremen-
us impact on mankind of the dis-
very of electric generation. It is
ubtful if any discovery has had a
eater influence on mankind.

The uses to which steam pressure
ve been put is another instance of
n's tireless efforts to make nature
rk for him.

There is, however, one force which,
hough of vast importance to us, is
t so well publicised. I am refer-
ng to centrifugal force.

Centrifugal force can be described
nply as that force which tends to
oduce movement away from the
ntre of a spinning object.

Many illustrations of the action of
ntrifugal force can be called to
nd.

Those who have had the misfortune to ride a bicycle through mud without mudguards know well enough what to expect. The mud picked up by the wheel is thrown from the tyre with considerable force, with the result that one's back becomes the resting-place for large quantities of mother earth.

Another example can be cited which is familiar to those who have visited some of those areas of pushing and shoving humanity called "Fun Parks."

A SLIPPERY SEAT

Some of these places have a large circular revolving platform of polished wood or metal. The idea is to mount the platform at the centre and attempt to remain there while seated and while the wheel revolves.

The chances are that it will be impossible to do so despite the tempting offer of a gold watch and chain to those who succeed.

Centrifugal force will throw the candidate to the outside of the wheel, where he or she makes a somewhat inelegant departure from the shiny surface.

The simple but dangerous toy sometimes used by children, both grown-up and otherwise, wherein a stone is slung from a sling, is another example of centrifugal force acting on the stone.

The whirling of the sling produces centrifugal force and the stone attempts to fly away, which it does immediately one string is released. The centrifugal force is felt by the increasing tension on the string.

"—GUN WAS LOADED"

I doubt whether David knew the cause of the damage done to Goliath when he hit him with the stone from his sling, but the result in this case justified the means and wrote "finis" to the most famous duel in the annals of history. One wonders what the world would have been like today if centrifugal force had not been there to aid David—and science!

This force has tremendous power. Consider one of the handicaps encountered by racing car drivers.

It has been often noticed that a car may have a flat tyre only after the speed of the car has dropped below 60 miles per hour. Further investigation has revealed that the tyre had been flat most of the time, but had not become apparent until the speed had dropped. Centrifugal force had caused the rapidly revolving tyre to maintain its shape.

This does not suggest a means of running a car without air in the tyres, unless some way is found of driving the car with flat tyres until a speed of over 60 miles per hour has been reached.

The tremendous speed of the earth on its axis exerts enormous strains and stresses on its own structure. This is particularly so at the equator. The great centrifugal force exerted has caused the diameter of the earth to be about 30 miles more in diameter at the equator than at the poles. This is the point of greatest force and is so great that the river Mississippi actually flows uphill. The mouth of this river is some three miles further from the centre of the earth than its source.

Centrifugal force is responsible for the orderly arrangement of the planets in their orbits. The force exerted by the planets by their revolutions helps balance out their mutual gravitational pulls.

Science has made use of centrifugal force in many ways. Probably the earliest applications were found in centrifugal pumps.

This pump makes use of atmospheric pressure combined with centrifugal force to pump water very efficiently.

The pump consists of a circular container in which rapidly revolving blades force the water to the outside of the container and creates a partial vacuum at the centre.

A pipe leads the water away from the outside of the container, while another pipe leads the water into the centre.

CENTRIFUGAL PUMP

The water is forced up the centre pipe by atmospheric pressure. This pipe leads into the source from which the water is to be pumped. Atmospheric pressure forces the water up this pipe to fill the partial vacuum created at the centre of the container.

This type of pump is also used to force air into ventilating systems.

The laundress, professional or domestic, can be thankful for centrifugal force for the action of the whirling dehydrator.

This now well-known contrivance takes the form of a perforated drum revolving rapidly in another drum. The wet clothes from the wash are placed into the perforated container, where centrifugal force throws the water from them and out through the holes into the outer drum from whence it is led away.

The same system is used to recover the spirit used in dry cleaning processes. It is somewhat superior to the old-fashioned wringer and ensures a more constant supply of intact buttons.

In 1875 a brainy chappie named Carl de Laval thought out a brilliant idea to separate the cream from the milk.

His line of thought led him to think that if he could spin milk fast enough in some sort of container the heavier milk would be thrown to the outside while the cream, being lighter, would remain somewhere near the centre.

CREAM OF THE JOKE!

He rigged a rough model with a spout at the outside and another near the centre.

By revolving the container rapidly, lo and behold, milk came from the outside pipe and cream from the centre.

The milk separator is used exclusively at the present time for the extraction of cream, although where the cream goes to afterward, is somewhat of a problem. It certainly is not in the "cream" cakes in cake shops.

Not till recent years has the action of centrifugal force been extensively applied.

Prior to 1940, about the only well-known application of the principle apart from the three already mentioned was in medical laboratories.

In these institutions a machine, known as the "centrifuge," was used for separating solids from solutions.

When blood is allowed to stand, the red blood corpuscles clot and separate from the blood plasma. This is a slow proces when it is desired to obtain large quantities of plasma for blood transfusion purposes.

The centrifuge takes the form of a rapidly revolving disc in which metal holders containing glass tubes are suspended.

by Calvin Walters

When blood is placed in the tubes and the centrifuge is revolved at about 1500 revolutions per minute, the tubes straighten out, and centrifugal force sends the heavier blood particles to the bottom of the tube, leaving the clear plasma at the top.

Vaccines and sera for immunisation are cleared of extraneous particles by this method in about 10 minutes. Clearing by settlement would take hours.

Today centrifuges are used for many other purposes and are built in a great variety of sizes.

In chemical factories they are used to remove moisture from chemical crystals, such as table salt.

These are of giant size and cost thousands of pounds. This cost is largely due to the extreme precision required in the making of them.

Tolerances of one ten-thousandth of an inch are required because any out of balance would cause vibration bad enough to bring about the destruction of the machine.

FAN DANCE

Everyone knows what would happen to an electric fan revolving at the comparatively slow speed of 2000 revolutions per minute, with one blade heavier than the others. Severe vibration would be experienced. The fan would come to pieces.

With speeds of thousands of revolutions per minute the vibration would be bad enough to cause the machine to explode.

In most manufacturing processes a speed of up to 50,000 revolutions per minute is used. This exerts a force on the substance in the machine of anything up to 60,000 times the force of gravity.

Some interesting applications of the centrifuge can be briefly cited.

The extraction of oils from orange and lemon peels was at one time a costly and wasteful process. The skins were squashed in tubs of water. After a time the oil which arose would be skimmed off and a ton of ora peel would yield only about tw three pounds of oil.

The present methods inc power presses for squeezing the from the rind in water, which is into centrifuges revolving at speed.

The oil is fed from one nozzle the waste water from another, over 2000 gallons of liquid is ha led per hour.

In the paint and varnish indu the quality of products has greatly increased by using centrif to remove foreign matter from terials which are too thick to strained or filtered.

Even in the chewing gum indu centrifuges play an important Their use is threefold. They ren hard matter which would be de mental to the masticating prope of the gum, and which would m the chewer look even more rid lous by becoming clogged in the sils. They purify the oil used in covering and dry the sugar w is dusted over the stick of gum.

The ink used in filling that me to good penmanship, the ball-poi pen, must be exceedingly fine to vent the ball from clogging more it does now. Centrifuges again c to the rescue and grade the ink ticles to the required consistency.

CHEWING GUM

The same process is used in refi lampblack used in rubber manu ture, clay for pottery and pigm used in paint-making.

The life-saving drug, penicilli made more cheaply with the ai the centrifuge. The mould from w it is made grows in fermenta tanks. The last minute grain of p cillin is extracted from this li by means of the centrifuge.

In experimental work the ce fuge machine is being run fa and faster. They are being use order to try to separate particle matter which have never before separated.

Speeds of 160,000 revolutio minute have been reached. At speed the force exerted makes a pound weight act like 600 tons.

A later machine reached a s of 1,200,000 revs. a minute. This erated a centrifugal force of seven million times the force of g ity, making a one ounce weight like 200 tons.

Later on, a physicist named Jesse Beams went off the beam made a little machine which he pended in a vacuum and got it re ing at 10 million revs. a mi which, to make it sound more fa tic, is about 166,000 revs. a sec He says he was trying to fi method of separating radioactive terials from matter.

As time marches on, more and uses are being found for the ce fuge and the action of centri force.

Maybe one day the income tax partment (I can't bring mysel capitalise these ominous words) use some such force to extract fine particles remaining in the kets of the taxpayer.

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0-600			x with external battery.

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0—2.5	0—2.5	0—5 mA	—22 to +3	1000—50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+4 to +29	
0—250	0—250	0—5 Amps	+18 to +43	*With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.

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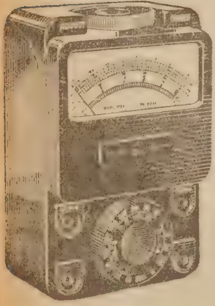

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0—10	0—10	0—50	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	*With external battery.
0—2500			

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Technical Review

TRANSIENTS AND LOUDSPEAKER DAMPIN

Recent work by J. Moir, M.I.E.E., featured in "Wireless World," throws light on the contentious subject of loudspeaker damping and its relationship to transient response. Experiments indicate that, as far as transients are concerned, the amplifier output impedance cannot be too low.

MOIR points out that there have been three schools of thought relating to the subject.

The first maintains that the use of negative feedback or circuits having low output impedance limits the transient response of a system. A second maintains that the lowest output impedance and the highest damping factor possible should be aimed at. Yet another school sides with group 2, but says that there is no point in reducing the effective output impedance from the transformer secondary below about 10 per cent of the voice coil impedance.

Moir's method of test was to apply abrupt pulses to the voice coil from a switched d-c source, observing the manner in which the cone tried to follow the square wave electrical impulse.

By using a micrometer and a pair of electrical contacts, he was able to measure the peak travel of the cone, while an oscillograph connected to the voice coil terminals showed the general behavior of the cone. Varying amounts of resistance in series with the actuating voltage similated amplifier output impedance and its damping effect on cone movement.

TENDENCY TO OSCILLATE

It was found that, with a minimum of electrical damping across the voice coil, the cone would "overshoot" its new position, due to its own velocity and mass. Returning towards the new position, it would overshoot again to a lesser extent, producing a damped train of waves. The process is repeated when the impulse is removed and the cone returns to its "at rest" position.

Figure 1a illustrates the effect, as revealed on the C.R.O. screen. The near-vertical impulse trace is not visible but the oscillatory pattern produced by the undamped cone cannot be mistaken. While square wave input exaggerates the position somewl the tendency for the cone to deve an oscillatory wave train is app ent, the oscillations representing added component not present in original signal.

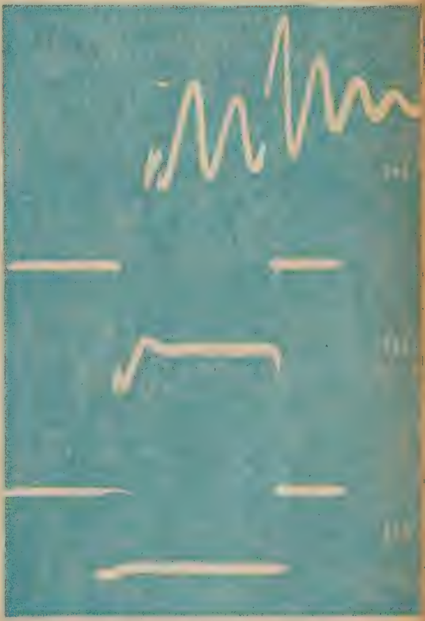


Figure1. Voltage across a voice coil when excited from high impedance source (a), from an equal impedanc source (b), and from a low impedance (c).

The trace 1b represents the sult when the damping resista is equal to the nominal voice impedance. The oscillatory tende has been greatly reduced, althou it is still evident.

In figure 1c, the damping resista has been reduced to approximat twenty per cent of the voice impedance and the damped w train has disappeared.

More detailed tests indicated t the damping resistance across a vc coil should be no more than h the voice coil impedance, this ra

(Continued on Page 85)

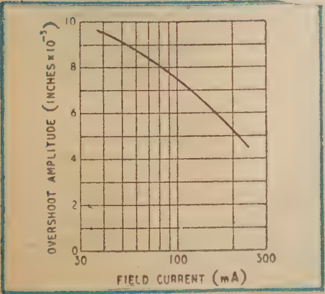


Fig. 2. The effect on voice coil "overshoot" of increased magnetic flux. Value of a good magnet is apparent.

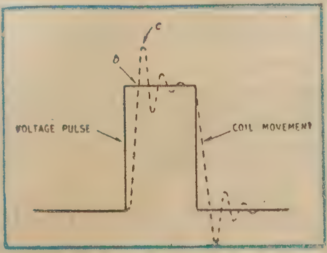
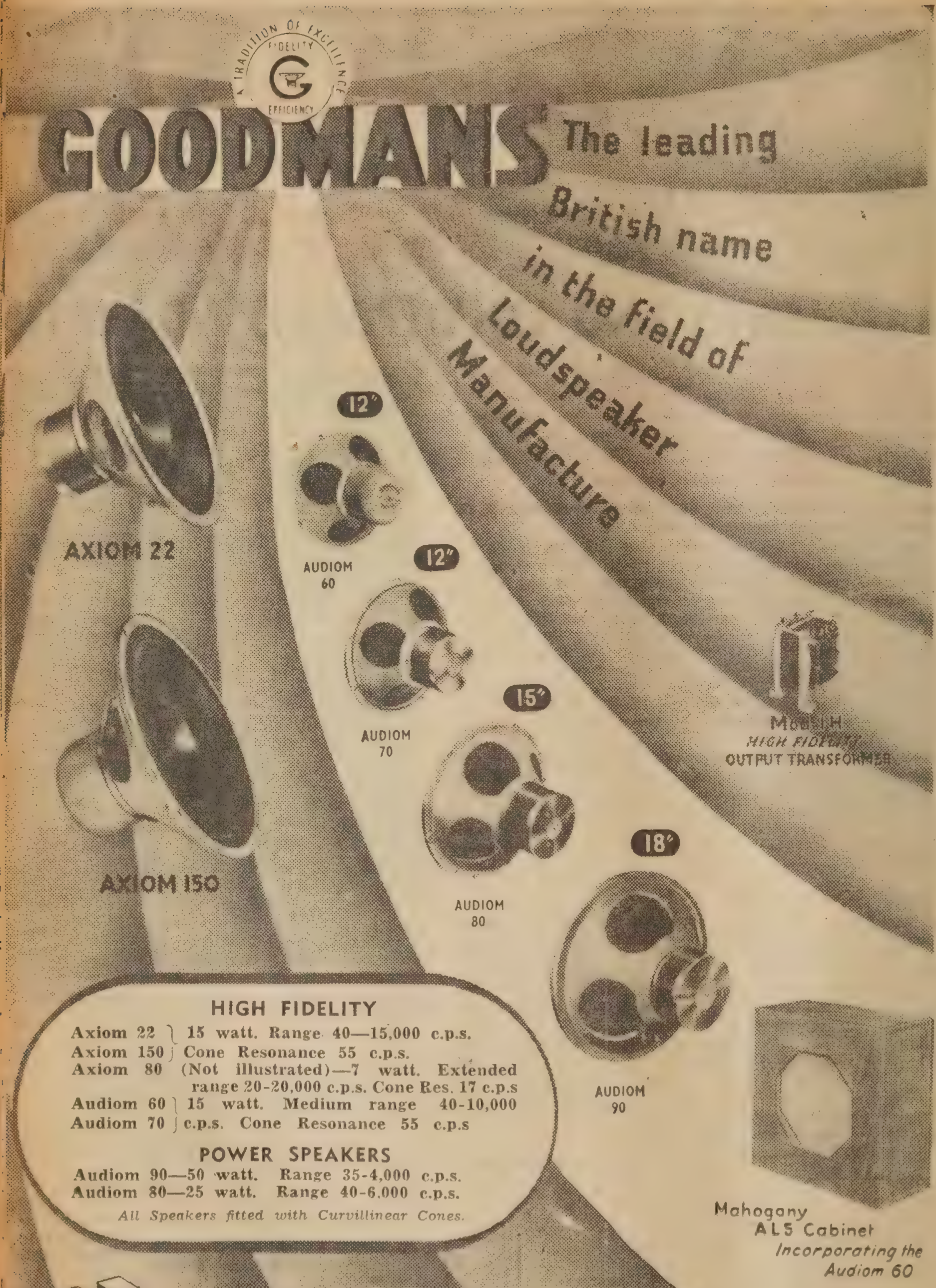


Fig. 3. The type of pulse applied to the voice coil under test and the trend of the coil movement (dotted).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THE CASE FOR TELEVISION "SPOT WOBBLE"

Television spot wobble, featured recently in these pages, is the subject of further comments by T. C. Nuttall, of Cenema-Television Ltd. While he agrees with the verdict of Major Ralph Hallows, his explanation of its effect on the picture goes more deeply into the subject.

MR. NUTTALL points out that the spot wobble technique has been used in the past:—

(1) to cover up faults liable to occur with certain methods of recording television programmes on film.

(2) To reduce screen saturation effects in high-power CR tubes for large screen projection systems.

(3) To remove line structure effects from bright, directly-viewed pictures on a CR tube screen.

The third application is the one which is of widest interst and subject of the present discussion.

The amount of flicker noticeable in a television picture is closely related to brightness. The brighter the picture, the more essential it becomes to use a high picture repetition rate. (Tests have shown that the American system, with 60 frames per second, can be projected at up to three times the brightness of the British system, using 50 frames, for the same amount of apparent flicker.)

In point of fact, the whole picture is not repeated 50 or 60 times per second, but the general outlines are filled in at that rate by the interlaced scanning system. The repetition rate of any particular line is only 25 or 30 as the case may be.

BRIGHTNESS EFFECT

If the brightness is increased sufficiently, the persistence of vision does not retain the alternative lines long enough to give a true interlaced effect. Rather, one set of lines is fading rapidly as the other set is being filled in. The eye, therefore, has the apparent option of seeing the pattern as an interlaced system or as a set of lines which change their position by a small amount each half-frame.

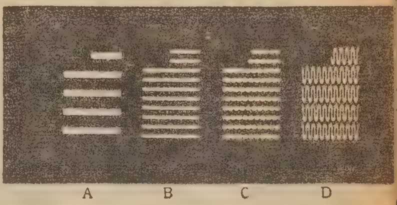
If the eye, in following a detail of the picture, catches the second possible illusion, it sees the pattern of lines as if they were crawling slowly up or down the picture. It becomes most disconcerting if the eye is allowed to follow the illusion instead of concentrating on the programme.

Technically, it is known as "interline strobing," or, more simply, as "crawling."

The worst example in practice is seen in wind-up titles, sometimes used as a prelude to plays, &c., where the picture and the eye are led vertically across the line structure.

HIGH DEFINITION

While the effect is not likely to occur with a poorly-focused, low intensity tube, it can be a serious problem with high definition equipment, particularly for some viewers whose persistence of vision is shorter than average. To say that the viewer must move away from the screen is fundamentally an expedient rather than a cure.



Illustrating (A) a small section of the line structure of a 188 line scan (403 line system) for a picture 2 feet high. (B) shows the desired effect of a twin beam scan and (C) how it could be approximated with a square wave field "wobble." (D) shows siniodal spot wobble.

The problem is actually not one of filling the gaps between the total number of action lines but action between the number of lines per scan. Viewers who maintain that they can see objectionable line structure are, as often as not, looking in fact at the number of lines per scan, which is only half the total active lines of the system.

Methods of obviating the effect envisage either a tube with a rectangular or elliptical spot or one which would paint two fine lines, side by side, instead of a single and more heavy line. At the present time, however, it is problem enough to obtain a controllable small round spot, without requiring one of more special shape.

An alternative would be to apply a high-frequency square wave fi to the beam so that it would, in eff trace two broken parallel lines stead of a single line. The eff would be to merge the line struct and obviate the tendency for the to produce the "crawling" illusior

It is virtually impossible to prod a high-frequency square wave fi of this nature, and the nearest pr ticable approach is a sine wave fi as already indicated. The ultim results approach the ideal fai closely.

Photographs published with article, and not suitable for furt reproduction, indicate that the loss definition is virtually nil, but t the elimination of line structure most effective.

BRITISH TECHNICAL DEVELOPMENTS

ENGINEERING and electricity have combined to speed up weathering tests.

In the past, these weathering tests, conducted in the open air, have wasted time and labor, owing to weather's notorious uncertainty.

This unsatisfactory situation has been remedied by the Birtley, England, firm, Decel Engineers, which has evolved a device that, in effect, produces any given weather conditions continually at will inside a drum.

Sunshine is simulated by light of high actinic value from a carbon arc lamp, rain by a spray of distilled water. In practice, the weatherer works as follows: The drum is opened, and on each of the three tiers provided, up to 45 test pieces (paint panels, cloth strips, or whatever) are suspended. The 250 volt lamp is lowered inside, and the drum closed. Connections are made with the separate cabinet which houses the air compressor powering the spray mechanism.

The test pieces are subjected to water from a nozzle during 30-60 degrees of the rotation, and to light, the intensity of which is automatically varied.

Applied electronics have also led to the mechanisation of dewpoint measurement. Knowledge of the temperature at which a given sam of air becomes saturated and con quently deposits dew (i.e., its de point) is of obvious interest meteorology and to industry. In past, an operative had to cons thermometers whenever readi were needed.

The new automatic recorder manufactured by the London, E land, firm, Elliot Bros. (London) L All its numerous refinements aim continuous, uninterrupted operati An important feature is the refr erator, which, indirectly, cools brightly polished aluminium thimb the surface of which is blurred wh dew is eventually deposited from passed over it.

Air (previously filtered if nec sary) is drawn over the thimb This is obliquely lighted by an el tric lamp, which also illuminates photo-cell! another, from abo views the light scattered from thimble surface. The two cells gether, control a heating device wh brings the temperature of the thim to the point required for dew f mation. This temperature is m sured by thermo-couples. The d ference between the two is magne cally amplified into a reading in grees centigrade on an indicator a recording device.

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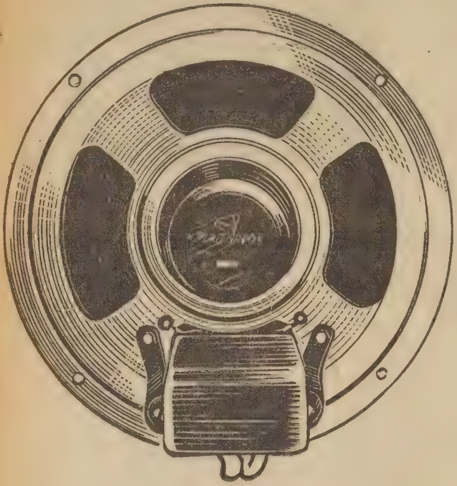

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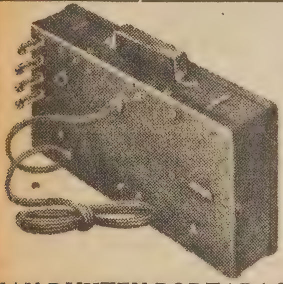

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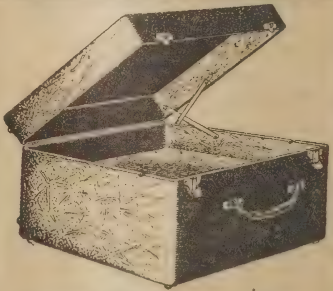

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DETAILS OF FIRST GAS TURBINE CAR

Further details are now available of the new Rover gas turbine car, which made its sensational debut in England a few months ago. Strictly an experimental project, the car represents the culmination of ten years of intensive research. It has demonstated the practicability of the scheme and opened the way for further development.

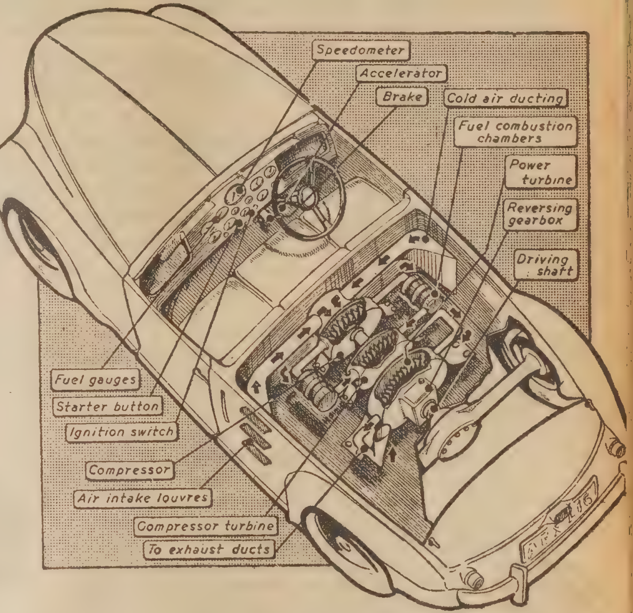
THE story behind the Rover car actually had its beginning in 1940, when the Company became associated with the efforts of Commodore Whittle and his staff in experiments with jet propulsion for aircraft.

Despite the disaster at Coventry, when the Rover factory was a target for German bombs, engines were developed from the original Whittle designs and brought to a stage where they were ready for quantity production.

At this stage, the project was handed over to Rolls Royce who carried on the production of the now famous Derwent and Nene gas turbines.

At the close of the war, lest the experience gained by technicians be lost the Rover Company took up a new programme of development covering small gas turbines of a type which might be suitable for road vehicles.

Under the supervision of chief engineer, Maurice C. Wilks, a staff of less than twenty men pursued the project using methods which involved, at times, a good deal of trial and error. But it was this team which produced a gas turbine while experts the world over were still debating its feasibility.



The body and styling of the car is similar to the standard 1950 model, but here the resemblance ends.

PRODUCTION PROBLEMS

Of the problems involved, Mr. Wilks told a correspondent: "When we went into this job we had no illusions — we did not start off with the idea that we would be able to make satisfactory car gas turbine engines in a year or so's time. We knew that it would take a long time, but we felt that as we were one of the few motor-car manufacturing firms in the medium quantity production class with this very valuable 'know-how' on gas turbine engines, it was most desirable to continue our work."

Mr. Wilks emphasised, "This is, in fact, what might be called a practical interim report on the progress of our work. We know we still have a long way to go before the gas turbine car becomes a marketable proposition, but this will show that we have gone some way on the journey.

"The present engine is really a piece of test-bed apparatus, and, in consequence, does not bear much resemblance to what the company has ultimately in mind for a motorcar, either in power output, dimensions or weight. It would be a mistake to regard this particular engine as representing anything approaching finality — in any case, in any future 'production' car we would certainly not put the engine where one expects to find the back seat.

"This car does, however, demonstrate that many of the major problems have been solved, and that it is possible to build a vehicle with only two-pedal control—accelerator and brake.

"It is obviously the Rover Company's intention to produce a gas turbine engine car as a marketable proposition, if, and when that becomes practicable, in which case it will vertainly be as good as—most probably better than — existing piston engine cars in respect of performance and weight. Probably though it will not be quite so good in respect of fuel consumption, but to balance that the performance will be superb."

HEAT EXCHANGER

The present engine was designed to include a heat exchanger, but as the design of this is one of the most difficult problems involved, its development is for the most part being done away from the engine, the initial engines being run without heat exchangers—in which condition their fuel consumption is more than twice what it would be in a good piston engine of equivalent power. With a heat exchanger, however, the gas turbine's fuel consumption comes down to within measurable distance of that of the conventional piston engine. Fuel may be petrol, paraffin or diesel oil.

For a road vehicle the gas turbine offers two pedal control, as there is no need for a clutch or manual ge change in the accepted sense. W a piston engine the problem is o of fit and wear; with the gas tu bine there are few close fits and the is very little wear, but balance is big problem, as it must be nea perfect.

The following leading particula apply to the car: wheelbase, 9ft 3 track, 4ft 4in; type of body, ope number of seats 2-3.

The general design of the c apart from the power unit and tra mission, is on conventional lines, a its external appearance normal.

POWER PLANT

The power plant, which is mount immediately ahead of the rear ax consists of a centrifugal compress with dual combustion chambers, ha ing a single-stage compressor turbi and an independent power turbi The latter is positively coupl through gearing, incorporating a r verse gear, and drives a conve tional rear axle. The fuel used kerosene.

The method of starting is by no mal car-type electric starter, wi push button on the instrument pan

The time taken to start the pow unit and to run up to idling spe is 13 1-5 seconds, and the car mov

(Continued on Page 23)

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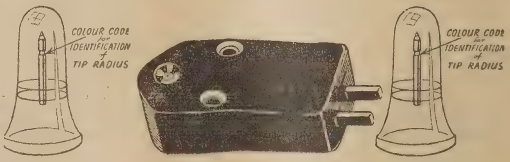
Three-way magnetic Cartridge provides a very neat solution to the problem of changing from Standard to Long-playing records. The basic requirements of high-fidelity reproduction, high output, durability and easy stylus change and replacement, are combined for the first time—in a cartridge measuring only 1⅝" x ¾" x 7/16" deep overall, and weighing 14 grams. This outstanding performance is achieved by making the stylus the armature and suspending it in a non-ageing damping system. The stylus is very light and rigid and weighs less than 0.1 gram. As a result the pick-up is able to respond with perfect fidelity to frequencies as high as 15,000 per second. In addition, the special damping and suspension system allows the armature to move freely in all directions, which gives automatic elimination of the residual tracking errors which exist in all pick-up arms. As a result of this the wave form and transient-response of the Goldring 3-way cartridge is exceptionally good.

THREE-WAY CARTRIDGE, COMPLETE WITH MICROGROOVE NEEDLE AND STANDARD NEEDLE .. **£3/3/0**

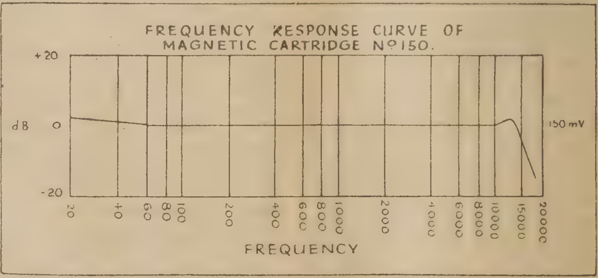

COLOUR CODE for IDENTIFICATION of TIP RADIUS
COLOUR CODE for IDENTIFICATION of TIP RADIUS

STYLUS COLOUR CODE

Tip radius	Colour	Tip Radius	Colour
0.001"	Yellow	0.003"	Blue
0.0025"	Green	0.0035"	Orange

SPECIFICATIONS

Output (at 3.16 cms/secs. RMS velocity)	150 millivolts
Frequency range	30-16000 cps.
Stylus pressure 78 RPM	14 grams
33 1/3, 45 RPM	7 grams
Coil impedance (at 1,000 cps.)	3.000 ohms
Coil resistance	2.000 ohms
Optimum load	50.000 ohms
Cartridge fixing	standard ½" centres
Cartridge weight	14 grams



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HOW JETS DRIVE BABY PLANES

Model aircraft, which have long exercised a fascination for enthusiasts and spectators, keep pace with many developments in full-sized aircraft and at times outstrip them in technological advance. Latest phase is the introduction of jet propulsion to models, and some remarkable developments have taken place in speed flying.

IN the class of miniature "jets," speedsters have set up records overseas of well over 160 miles an hour.

Illustrated in these diagram-sketches are model aircraft operated by jet thrust from both solid fuel (rocket-type) and liquid fuel which burns when mixed with the air-stream passing through the engine (jet engine).

To understand the operation of jet propulsion, it is necessary to realise that the jet of gas from either a rocket or a jet engine does not drive the missile forward by pushing against the surrounding air. All the forward thrust takes place inside the casing of the rocket or within the jet motor itself.

EXPANSION

Assuming that a suitable fuel is ignited inside a closed vessel, the expanding gases caused by the burning fuel press out on every part of the internal surface. Under such conditions, the pressure would build up until the casing would burst.

If we have a plug at one point—let us say the base—the hot gases will then rush out in a high-speed jet, and the pressure at the entrance to the jet pipe will be reduced to the pressure of the atmosphere. The expanding gases are still pressing on the remainder of the casing, including the inside of the nose, directly opposite the jet pipe. An unbalanced pressure is thus set up inside the nose, driving the missile forward.

The sharp-nosed monoplane (top) is powered with a "Dynajet" engine. The fuel tank is placed well forward in the small "fuselage," and from it liquid fuel is sprayed into the combustion chamber.

The engine is mounted on the fuselage from a point above the wings, the tail pipe leading back to the nozzle which is to the rear of the tailplane.

MIXTURE BURNS

In the combustion chamber the liquid fuel forms a fine mist which mixes with the air. The inflammable mixture, once ignited, continues to burn. The bases escape from the tail pipe, giving a forward thrust which drives the model aircraft forward.

A model of this type has exceeded a speed of 162 miles an hour in flight.

The "Juggernaut" jet engine (centre) operates on the pulse, or resonant-jet cycle. This principle was used in the wartime German V-1 flying bomb.

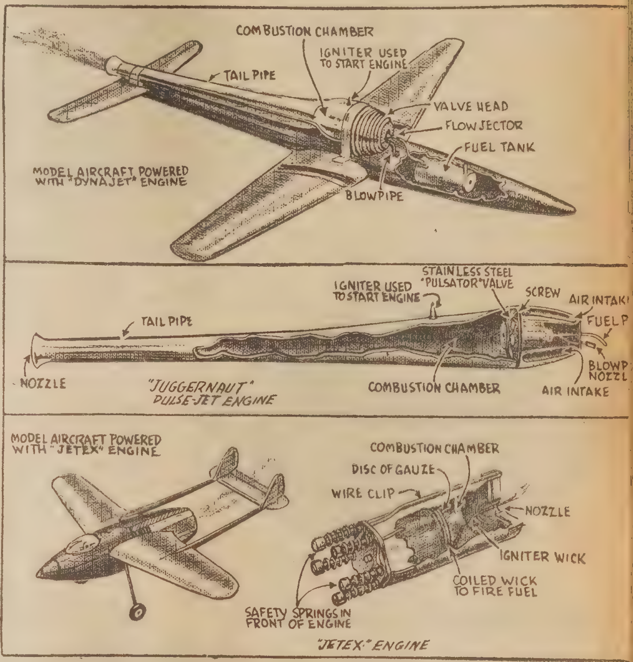
The only moving part of the engine is the stainless steel valve, which admits the fuel-air mixture and then temporarily snaps closed when the thrust comes from the burning mixture. The valve pulsates at a phenomenal rate—from 200 to 400 times a second—opening to admit the fuel and snapping shut as it is fired.

Expansion of the burning gases provides forward thrust.

The third model is powered with the "Jetex" engine—a rocket or sc fuel type.

The fuel is set off by igniting wick which extends back thro the nozzle. The wick is coiled al the rear of the charge, and once fuel material is ignited it bu steadily. The expanding g escape through the nozzle, dri the model aircraft forward.

The fuel charge of the Jetex gine is replaced after each fligh


COMBUSTION CHAMBER
IGNITER USED TO START ENGINE
TAIL PIPE
VALVE HEAD
FLOW SECTOR
FUEL TANK
MODEL AIRCRAFT POWERED WITH "DYNAJET" ENGINE
BLOWPIPE
STAINLESS STEEL "PULSATOR" VALVE
IGNITER USED TO START ENGINE
SCREW
AIR INTAK
FUEL P
TAIL PIPE
BLOWP NOZZL
NOZZLE
"JUGGERNAUT" PULSE-JET ENGINE
COMBUSTION CHAMBER
AIR INTAKE
MODEL AIRCRAFT POWERED WITH "JETEX" ENGINE
COMBUSTION CHAMBER
DISC OF GAUZE
WIRE CLIP
NOZZLE
IGNITER WICK
COILED WICK TO FIRE FUEL
SAFETY SPRINGS IN FRONT OF ENGINE
"JETEX-" ENGINE

THE FIRST GAS TURBINE CAR

(Continued from Page 21)

forward in a further 3 2-5 seconds.

Control is simple from standstill to maximum speed, and is solely by means of the accelerator pedal, the only other driving control being the brake pedal.

The reverse gear is operated by a lever which functions normally.

Under the test the car was driven for five laps on a circuit of the proving ground measuring 2.75 miles per lap, during which the Royal Automobile Club observers travelled alternately as drivers and passengers.

No attempt was made to at maximum speed, but during course of the test a speed exceec 85 mph was readily attained, which speed the compressor-turk revolution counter indicated 35 rpm.

In a test of acceleration fron standstill, the car smoothly attai 60 mph in 14 seconds.

Although no provision for silenc the exhaust was observable, the ume of noise was not excessive unpleasant, but was naturally acc tuated during acceleration.

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THE NEW COLLARO MODEL RC500 RECORD CHANGER

Available in either crystal or lightweight magnetic head plays either 10" or 12" discs.
Manually mixed.
Fitted with reject, stop, and automatic start.

LIST PRICE—£10/15/-

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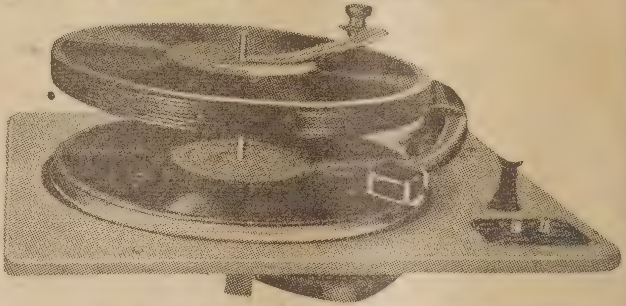

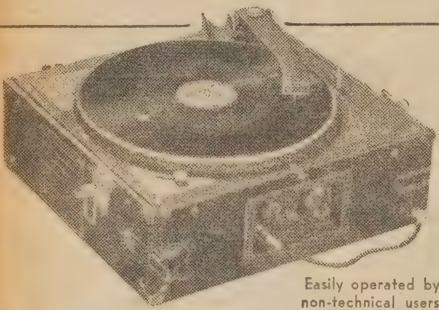

Easily operated by non-technical users

THE BRS MODEL R33 PORTABLE RECORDER.

Complete with microphone, amplifier, and two speakers, enclosed in an attractive carrying case, this unit is capable of performing the following functions.

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(2) RECORDING FROM RADIO OR PICKUP
(3) PLAYBACK FROM RADIO
(4) PLAYBACK FROM COMMERCIAL RECORDINGS
(5) A SMALL PUBLIC ADDRESS SYSTEM

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THE SENSATIONAL NEW 'ACOS' GP20 MICROCEL PICK-UP

Acclaimed overseas as the greatest postwar development in pick-up design.

10 inch, 12 inch and 16 inch discs.

Interchangeable head for microgroove.

FEATURES —
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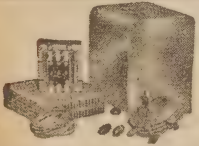
Needle pressure less than ½ ounce.

LIST PRICE — £4-17-6



Battery Charger Kit. Homecrafts 6 volt 4 amp. Battery Charger Kit. Kit includes 6 volt 4 amp. English Selenium Rectifier, transformer, black crackle finish metal case, 2 terminals and hook-up wire. Complete kit, as illustrated, only £4/10/-. 12 volt 2 amp. Kit. 5/- extra.

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"Collaro" Rim Drive Electric (A.C.) Gramo motor, complete with Crystal Pick-up, £6/-/-. Above Motor, complete with Magnetic Pick-up, £5/8/6.

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HYPERFIDELITY PICKUPS

HEADMASTER, complete with 3 cartridges, Tonaliser and Transformer	£10/14/6
121 Lightweight with Sapphire	73/10
100 Standard Magnetic, Walnut	45/6
100 Standard Magnetic, Ivory	49/6

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NEWS AND VIEWS OF THE MONTH

Commercial Television

IT is reported that Federal Cabinet will invite private companies to participate in the development of television services in Australia, and that the Government will be prepared to issue licences to such firms to broadcast programmes.

This report seems to clarify the position concerning national and commercial radio stations. It determines that policy shall be to provide ether space for both—a policy which is likely to produce the best service for the public.

So far, no mention has been made of the number of stations which will be licensed, but the indications are that not more than two stations in each capital city can be expected for some time to come.

It would appear probable, therefore, that one of these will be operated by the ABC and another by the Federation of Commercial Stations.

Although presumably any private concern could apply for a commercial licence, which need not necessarily be given to an existing broadcasting company, a combined effort operated by the commercial stations in each capital city, seems logically to possess the most attractive resources to do the job. It is fairly safe to assume, also, that some effort will be made by combined commercial interests to obtain whatever licences the Government is prepared to grant control.

Few can fairly quarrel with participation both by the ABC and private interests in television. Nor can they quarrel with the principle of careful control in the allocation and number of licences available to each group. As has been pointed out more than once in our columns, an ABC monopoly of television is just as undesirable as would be unrestricted private enterprise. The task of providing worthwhile programmes will tax our resources and economy quite severely, and there is no room at all for wasted or dissipated effort.

Little by little, the television pattern is falling into place. It is not likely, however, that all the necessary pieces will be assembled for some time to come. Add to this the period necessary to obtain and prepare equipment, and we have a period probably of years which must elapse before sets are for sale.

★ ★ ★

Set Manufacture

Many of the receiver manufacturers have progressed quite a distance in their experimental work in television receiver manufacture. A of them are prepared to say th the job is proving to be a hu one, which only begins when t laboratory models are ready manufacture.

The factory organisation a training of staff required to ma good sets is something which w necessitate a start from the grou up. It is a proposition of such magn tude that some big American fa tories have discontinued the man facture of highly profitable radio se to concentrate all their efforts television.

This is, of course, a reflection television growth, but it is also indication that the facilities for tel vision receiver manufacture just ca be tacked to an existing facto without the expenditure of conside able effort and capital.

We only hope that when televisi begins to move, our own radio fa tories will not neglect their rac projects in favor of the new art.

RADIO CROSSWORD PUZZLE, No. 34

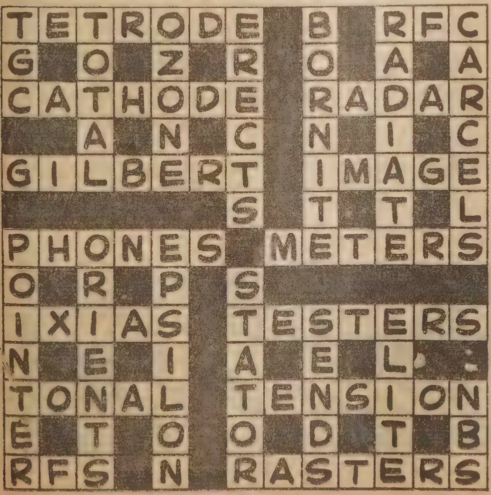
ACROSS

1. Valve holder.
4. He tries out sets.
8. Moving parts.
10. Ready for soldering.
11. Receiver.
12. Black.
14. Therefore.
15. Produces new current.
18. Accumulator.
21. Way out.
22. Unit of time.
24. Poem.
26. Radioactive element.
27. Type of storage battery.
28. Unit of luminous intensity.
29. Frequency units.

DOWN

1. Valve element.
2. Positive ion.
3. For hearing.
5. Give forth.
6. Front ends of receivers.
7. Receivers.
9. Tunes in stations.
13. Four-element valve.
14. Symbol for efficiency.
16. Urn.
17. Measuring system.
18. Liquid insulating material.
19. Dug from the earth.
20. Changes crystal's frequency.
23. Adjust for listening.
25. Type of currents.

BELOW—LAST MONTH'S SOLUTION



T	E	T	R	O	D	E	■	B	■	R	F	C
G	■	O	■	Z	■	R	■	O	■	A	■	A
C	A	T	H	O	D	E	■	R	A	D	A	R
■	■	A	■	N	■	C	■	N	■	I	■	C
G	I	L	B	E	R	T	■	I	M	A	G	E
■	■	■	■	■	■	S	■	T	■	T	■	L
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O	■	R	■	P	■	S	■	■	■	■	■	■
I	X	I	A	S	■	T	E	S	T	E	R	S
N	■	E	■	I	■	A	■	E	■	L	■	■
T	O	N	A	L	■	T	E	N	S	I	O	N
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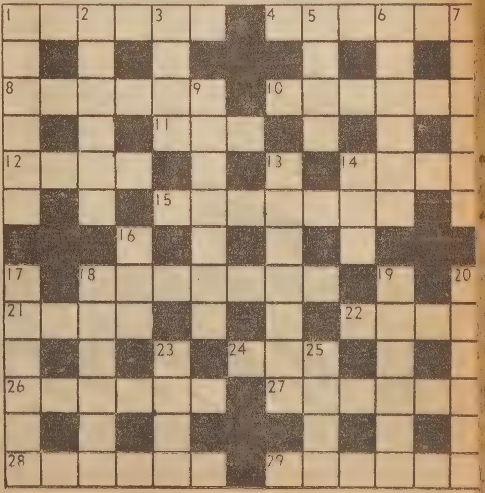
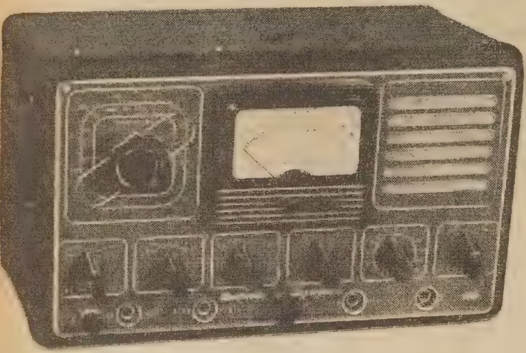
R	F	S	■	N	■	R	A	S	T	E	R	S



University news:

SIGNAL TRACING & SET ANALYSIS



With the most up-to-date and Versatile Instrument

THE SUPERTRACER MODEL AST

This is the most modern, up-to-date, and efficient service instrument that anyone could desire. It is easy to use and gives rapid and accurate location of faults in radio receivers and similar equipment. It speeds up testing, servicing, and production, and will rapidly detect faults which render a receiver inoperative, or which make it intermittent or lacking in sensitivity, or which cause oscillation, distortion, or hum.

The instrument comprises a two-stage tuned R.F. amplifier, a diode detector, and two-stage A.F. amplifier, and, of course, a loudspeaker and power supply. In addition, a vacuum tube voltmeter measuring up to 500 volts A.C. or D.C. at a resistance of 11 megohms on D.C. and 10 megohms on A.C. is provided. The tuning range of the R.F. circuits is 175 to 490 K.C., 550 to 1550 K.C., 1.5 to 4 megacycles, and 6.8 to 18 megacycles. R.F. sensitivity is such that input voltage of the order of a few millivolts may be detected on all ranges, so that the instrument is suitable for use in any district where alternating power mains are available. A capacity type R.F. multiplier in the input circuits in conjunction with the V.T.V.M. enables stage gain measurements to be made.

TEST PROBES: The R.F. test probe is fitted internally with a very small series capacity of a few micro-microfarads, so that it does not produce an appreciative detuning effect when applied to the grid or plate of R.F. or I.F. stages in a receiver. The A.F. test probe is a conventional shielded lead for feeding A.F. into the tracer or A.F. out from the tracer for testing A.F. amplifiers or speakers. The D.C. probe contains a series 1 meg isolating resistor, so that the V.T.V.M. may be used to measure plate bias or A.V.C. voltage under actual operating conditions without disturbing the action of a receiver.

VACUUM TUBE VOLTMETER: The V.T.V.M. features a centre zero scale for direct voltage measurement, so that voltages which are either positive or negative with respect to a receiver's chassis are instantly indicated without the necessity of reversing test leads or operating a reversing switch. Zero is at the left for alternating voltage ranges, and operation covers the audio frequency range. Voltage ranges are 0/5, 0/25, 0/100, and 0/500 volts at an input resistance of 11 megohms on D.C. and 10 megohms on A.C. ranges. In conjunction with the amplifying stages of the tracer, the meter will indicate R.F. or A.F. voltages down to a value of less than 1 millivolt. Indications are provided by a large, clearly marked rectangular meter with illuminated scale fitted in an attractive modern plastic case measuring 4¾" x 4". The V.T.V.M. and tracer may be used simultaneously for observing signals at two distinct points in a receiver. This feature greatly facilitates location of intermittent faults. Operates from A.C. 220 to 260 volts.

RADIO & ELECTRONIC TEST EQUIPMENT

University

Made by University Graham Instrument Co., 5 North York St., Sydney. 'Phone BO3169 (2 lines).

Broadcasting power

THE chairman of the Australian Broadcasting Board has announced that 68 country broadcasting stations are being considered for an increase in power to improve their services. After discussions concerning service area in the light of present day distribution of population, and the desire to give better service to country people, the Board is prepared to grant higher power.

The general trend throughout the world, said Mr. Fanning, the Board's chairman, is to increase the power of broadcasting stations, and the Board is anxious to ensure that Australian broadcasting services should keep pace with modern developments.

Coincidental with its study of the question of power for all broadcasting stations, the Board is examining various other methods which might be adopted for the purpose of effecting improvements in the service provided to listeners, including the possibilities of re-arranging medium frequency allocations to permit the more efficient use of the limited number of channels which are available for broadcasting stations under the International Radio Regulations.

In the matter of power, it might be profitable to consider more than merely the country listeners. Compared with the rest of the world, as Mr. Fanning points out, Australian stations are well down in the scale of power. As a result, coverage even from city stations is quite patchy. Higher power would not only improve this position, but would help to overcome the ever present bug-bear of electrical interference.

Indeed, of the available weapons with which to fight interference, increased power might well prove the most successful.

Most city stations now have reasonably good broadcasting sites, and adequate power would allow them to make the best use of it.

* * *

Flying saucers

THE daily press carried recently what are claimed to be the first actual pictures of a flying saucer, snapped by an American farmer.

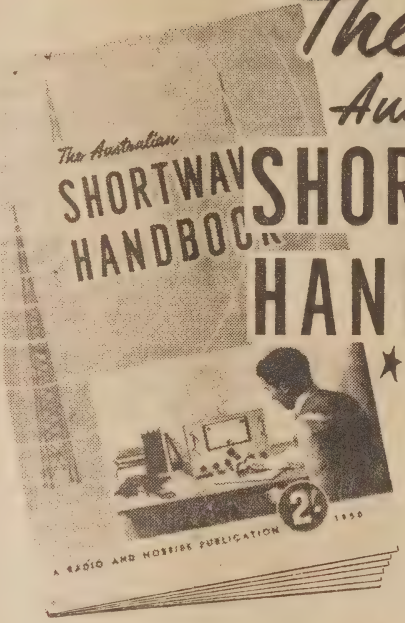
Early reports about flying saucers met only with ridicule and stories about optical illusions. While not very conclusive, in themselves, the photographs, together with a report from two local airline pilots, must force one to the conclusion that there is something very tangible behind all the vague rumors and reports.

Recent research into jet and rocket power, lumped with general atomic research, may easily have led to the quiet development of an "aircraft" which dispenses altogether with aerofoil surfaces and relies on jet reaction for both lift and forward motion.

The authorities, whom one would expect to be most concerned, are apparently taking little notice of it all. Either they take a lot of convincing or else someone has gone farther along the road of development than it is politic to admit right now.

The book you need for all the latest SHORT WAVE information.

The 1950 Australian SHORTWAVE HANDBOOK



a RADIO and HOBBIES Publication

A 124-Page guide for short wave listeners and experimenters with these up-to-the-minute features:

★ All the Australian and New Zealand amateur call signs.

★ Short wave broadcast station call signs and frequencies.

★ Construction details of receivers, transmitters and useful test equipment.

★ A NEW 100-watt all-band transmitter.

★ A NEW double-change amateur superhet—a NEW baby short-wave set — a NEW high-performnce dual-wave receiver.

★ INFORMATION: Short Wave listening. Verification cards. Learning the morse code.

Now being prepared—out soon

ORDER A COPY FROM YOUR NEWSVENDOR

A NEW APPROACH TO HIGH-

Sound reproduction is probably the greatest single interest among the readers of Radio and Hobbies. This article, from the officer in charge of National Stations 3LO-3AR, outlines the ideas of a broadcast engineer. It leads next month into a description of a completely different type of radio tuner for wide-range reception.

MANY radio enthusiasts make the attainment of fidelity reception e of their chief interests, and the llowing is intended as an aid to ose who may desire a better unrstanding of its underlying prinples.

It is, therefore, appropriate to ben with a comparison between the iaracteristic sounds heard direct om a musical performance and ose from an average receiver durg a broadcast of that performance.

OMPLEX SOUNDS

When listening to an orchestra ndering items in a theatre, a oticeable feature is the enormous umber of simultaneous sounds of idely differing frequencies, and iaracteristic qualities, which give the rendition a perspective or epth, a fullness of volume or body, id a richness of tonal "color," even hen the orchestra is playing softly.

This can scarcely be said of the ounds that emanate from the average eceiver. Many of those characterisc sounds, of the higher frequencies particular, are entirely missing: lacks perspective and body, and is clined to be hard and "colorless." he average set is, therefore, a poor eproducer of the original rendition.

To obtain a high degree of fidelity, nphasis has, in the past, been ressed on the necessity for a FLAT esponse characteristic in the audio nplifier: that the loudspeakers iould be of high quality, assembled special baffles, and provided with ividing networks to separate the inctions of high frequency speakers om those reproducing low frequenes. Furthermore, that the speakers should deliver appropriate audio powers in rooms specially furnished for their acoustic qualities.

Most of these features are indeed essential, but there are others in a different category which have not received the attention they richly deserve.

For example, when a performance is reproduced in a hard and colorless form, characterised by piercing intensity, then the power levels and furnishings assume considerable importance; but their importance diminishes as fidelity is improved. The higher the degree of purity in the wave forms of reproduction, the higher also may the power levels be raised toward the threshold of feeling, before the sounds are considered to be intolerably loud. An effect such as this might possibly lead to the assumption that the ear has some peculiar characteristic relative to power levels and loudness.

OUR LIMITATIONS

The ear is, in fact, a poor judge of the absolute power levels of sound, as may be gauged from the following two examples. In the first example, if a reader says to his friend, "The busy city street is seething with visitors," he will immediately notice the predominance of sibilants, and the very small effort of speech required. But, if he next says, "The public no longer buys unadvertised goods," he would find his throat opening up, and his lungs pumping large quantities of air. To repeat the latter sentence many times may cause fatigue.

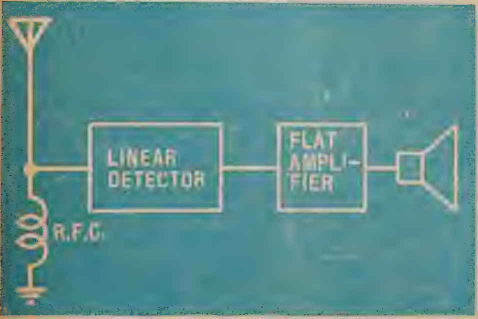
When these sentences are spoken into a microphone, the power levels indicated by a volume indicator may average say minus 10 db for the first sentence, but possibly plus 2 db for the second. Even though there is a marked difference in their relative power levels and frequency ranges, both sentences are usually heard with equal facility.

For our second example, a microphone and volume indicator are again required, but on this occasion in conjunction with an orchestra which consists of a number of instruments of various types and dimensions. The bass instruments are relatively large, and they deliver most of the sound powers, while the small high note instruments deliver comparatively small powers.

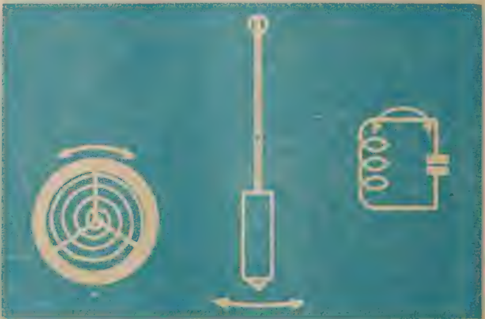
When the orchestra begins to render an item which opens with the bass instruments, the volume indicator may indicate say plus 2 db. As the performance continues and more and still more of the smaller instruments are brought into play, the rendering seems to grow louder and still louder; yet, while all this growth of apparent loudness is taking place, the rise in power level is extremely small indeed; it is almost the same as at the beginning of the item.

FREQUENCY CHARACTERISTIC

The listener's ear possesses a natural Frequency Response Characteristic which is far from linear. In addition to this, the greater number of simultaneous frequencies generated by sibilants and small high note instruments influence more of the mechanism of the ear, which results in an apparent greater loud-



Basic receiver has untuned input circuit. Addition of tuning components immediately restricts response to sidebands. The more selective a receiver is, the poorer its fidelity.



Illustrating the analogy between a balance wheel, a pendulum and an electrical tuned circuit. Each resists any effort to make it oscillate at a frequency other than the resonant frequency.

FIDELITY RADIO RECEPTION

By S. V. HOSKEN

ness. When certain discords are rendered, the effect is most unpleasant.

Hence it appears that although the ear is a poor judge of absolute powers in sound, it is critical of the number of simultaneous sound frequencies. It is also critical of frequencies which are in combination. And so it is critical of distortion which results from unwanted frequencies being added to those generated in the original performance. When those added frequencies are in ODD harmonics or ODD multiples, the psychological effect is much worse by a ratio of approximately 5 to 3, or nearly twice as bad as when they are EVEN harmonics.

As previously shown, practically all the emphasis has been stressed on audio requirements but the characteristics of R.F. amplifiers and detectors assume equal importance, because they also are equally capable of introducing distortion.

Distortion can be infinitely worse than most forms of poor frequency response. For example, many of the high frequency sounds that are heard with facility when a brass band is rendering items in a hall, are entirely lost when rendered out of doors.

DISTORTED?

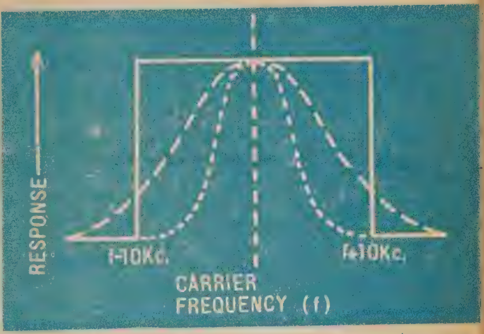
In these circumstances the listener would not claim that the band sounds distorted merely because it is playing out in the open air.

It would, however, sound distorted to a Broadcast listener if additional unwanted frequencies were introduced by the receiver during a broadcast of the performance.

The indiscriminate use of expansion frequently results in distortion. It would first be necessary to know the precise characteristic of compression, so that its exact opposite may be applied in expansion if distortion is to be avoided.

The source of poor response may also be the source of severe distortion. A poor response also robs the performance of its richness of tonal color. Hence a good FLAT response is essential to a high degree of fidelity. Since the average receiver includes an R.F amplifier and a detector in addition to its audio amplifier, the receiver as a whole, from aerial input to final output, should possess an OVERALL linearity of gain, as well as a FLAT response extending to the limits of the audio spectrum.

These should preferably be derived in each separate function operating in the receiver. Since it is not always possible to cover the entire spectrum, a response that is FLAT from 35 cycles/second to at least 10K cycles/second is a good compromise. (K) equals 1000: therefore 10K equals 10,000.



☆

R.F response curve should ideally extend to at least 10Kc. either side of the carrier (solid line). A T.R.F. response may simulate the dashed line while the dotted line could well be for a sharp superhet.

☆

CONFLICTING FACTORS

Wide response and a high degree of selectivity are incompatible. They possess opposite characteristics but this fact is of no serious consequence to the listener whose chief concern is fidelity.

Fading introduces distortion, hence he is not primarily concerned with the selection of a large number of transmissions from distances beyond their normal fade-free service areas. Fortunately, a high degree of selectivity is not essential to receive local stations.

The ideal condition for wide-band reception would be one in which a basic receiver consisting of a linear and FLAT detector, followed by an audio amplifier possessing similar characteristics, is employed without tuned circuits of any kind, and placed in the strong induction field of a broadcasting station. The input grid circuit to the detector would merely include an R.F. choke, and small antenna.

BASIC RECEIVER

The author employs a basic receiver under these conditions as a standard of reference to determine the highest attainable degree of fidelity, since there would be no discrimination between the carrier and any of its sideband components which convey the transmitted intelligence.

Beyond the limits of the induction field, the reception of broadcast programmes depends primarily on the properties of the tuned resonant circuit. The various ways in which these properties may be viewed will now be described with the aid of a mechanical analogy in the form of that well-known hair spring and balar
wheel of a watch.

An observer will notice that t
balance wheel oscillates to and f
with an equivalent pendulum actic
Further, that the frequency of osc
lation is remarkably constant.

The wheel possesses inertia
virtue of its mass (M). While
motion it also possesses kinetic ener
which results from the product
its mass (M) and the square of
velocity (V). The kinetic energy
therefore the greatest at the highe
velocity, when the wheel is passi
through the mid-point of its oscil
tion, and all driving force has be
expended by the spring.

OSCILLATORY EFFECTS

On passing beyond the mid-po
the wheel begins to give up its ki
tic energy by developing potent
nergy as it winds up the spri
When the wheel finally comes
rest at the end of each oscillation,
kinetic energy has been converted
potential energy in the spring.

The spring possesses potent
energy by virtue of its tension a
displacement (stress and strain). T
potential energy is reconverted
kinetic energy by a reverse proc
every time it drives the wheel
another oscillation. And so the alt
nate conversion, from one form
energy to the other, continues w
each oscillation of the wheel.

If the mass of the wheel and
the length of the spring were
creased, the frequency of oscillat
would decrease; and vice versa.

The tuned oscillation circuit p
sesses properties analogous to
mechanical example. The capacita
of the tuning condenser represe
the length and stiffness of the spri
while the energy stored in the c
denser (capacitor) is potential ene
by virtue of dielectric stress a
strain which manifests itself as
force of voltage (E) at its termin

The inductance (L) of the tun
coil corresponds to the mass (
of the wheel; the flow of current
to its velocity (V). The ene
stored in the magnetic field ab

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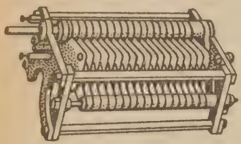

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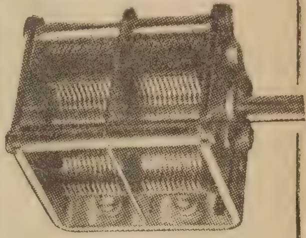

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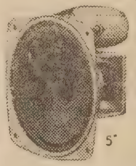

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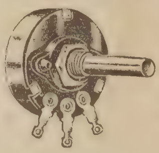

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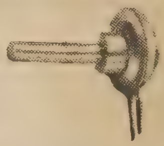

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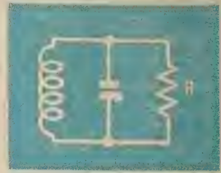
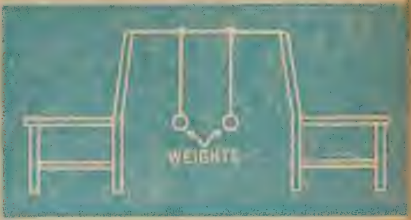
SYDNEY

(Below) Loading a tuned circuit reduces Q and assists in obtaining better fidelity. However, the process cannot be carried too far or the tuned circuit becomes useless as such and the receiver fails to select and separate even the local stations.





Double-tuned resonant transformers, as used in superhet I.F. channels, are excellent for selectivity but bad for fidelity. Transfer of oscillations, as illustrated by mechanical analogy, produces out-of phase components which are readily mixed with signal voltages by non-linear amplifier characteristics.

the coil is equivalent to the kinetic energy stored in the wheel, while the inductive reactance represents inertia.

Like the mechanical analogy, an INCREASE in the inductance of a coil and/or the capacitance of the condenser will DECREASE the frequency of oscillating currents and vice-versa.

Small amounts of energy are initially added by the escapement to the wheel to overcome inertia and relatively large amounts of energy are eventually stored in the wheel—hence the wheel has a magnifying action. The small amounts must, however, continue to be added intermittently to compensate for losses due to friction and the actual magnification is the ratio of energy stored to each small amount added.

DAMPING

Similarly in the tuned circuit, resistance (R) is the equivalent of friction: while the magnification of the coil is the ratio of its inductive reactance to its resistance (R) and commonly denoted by the letter (Q).

Reverting to the wheel an observer would notice as each short pulse of energy is added by the escapement to the wheel, it is immediately converted into the form of simple harmonic motion by the pendulum action of the wheel. And like the wheel, the pendulum action of the tuned circuit immediately converts short pulses of electrical energy into an equivalent sinusoidal wave form.

Again, like the mechanical analogy, the greater the magnification (Q) of the coil, the more difficult it would be for the current to oscillate at frequencies other than that which is determined by the quantities of its reactive components (LC), appropriately called the oscillation constant. Hence to make (LC) less effective so that the current may readily be forced to oscillate at any one of a number of frequencies on either side of resonance, a dissipating resistance (R) must be added to damp the circuit and reduce the (Q).

The significance of the foregoing will be further enhanced by a short description of some of the functions operating at the transmitter, where valves deliver relatively large amounts of power to tuned circuits during part only of each oscillation cycle, while the pendulum action of the circuit is employed to complete the cycle in a sinusoidal wave form.

CARRIER AMPLITUDE

The wave forms of speech and music are on the contrary exceedingly complex and variable, as may be gauged by listening to a large orchestra and, when they are applied to modulate the transmitted carrier, they effect corresponding complex and rapid changes in the amplitude of oscillating currents.

The amplitudes INCREASE with greater additions of power from the valves ,and DECREASE by dissipation during lesser additions of power, in sympathy with the wave shapes of speech and music.

Having once started oscillations they might continue indefinitely and constitute perpetual motion if there were no dissipating resistance in the circuit.

On the other hand, if the resistance exceeds a critical quantity (2 divided by root L/C) it will dissipate power at an excessive rate, like worn out bearings in the watch, and rob the circuit of its pendulum action, so that there would be no oscillating currents.

The optimum compromise between these two extremes is to dissipate power from the circuit at the same rate as the supply from the valve diminishes during falling characteristics in the wave forms of modulation. This rate of power dissipation should therefore concide with the highest audio frequencies.

IN the next issue, Mr. Hosken will go on to describe a so-called "Band Acceptor"—something completely different in the way of tuning units. Whether you decide to build it or not, this Band Acceptor introduces a number of interesting new principles and ideas.

Looking at this feature from another angle, the resistance reduces the strength of pendulum action and permits the current to oscillate at any one of a band of frequencies on either side of resonance. The width of this band on both sides of resonance coincides with the highest audio frequency at which dissipation can be effected by (R). The higher the audio frequency, the wider the band-width necessary to accommodate it; hence (R) must be greater.

BANDWIDTH

Thus, having fixed the quantities of inductance and capacitance for a given resonant frequency, the response or band-width of the circuit is proportional to (R). The transmitter circuit works into a load such as an aerial radiator. The load consumes power and is equivalent to adding (R) in the oscillatory circuit.

In practice the optimum rate-of-transfer of power from the oscillatory circuit to the load correla
power efficiency and band-wid
without sideband attenuation or hi
note loss. This is made effective
adjusting to within close toleran
an appropriate ratio of (KVA)
the tuned circuit, to (KW) consum
in the load, written thus: (KV
KW). The actual ratio depends
the type of RF amplifier.

Since this ratio is related to pe
dulum action and damping resi
ance the connection between (KV
KW) and (2pifL/R) and (Q) m
readily be seen. It is obvious th
the ratio (KVA/KW) at the tran
mitter has no equivalent counterp
in the values of (Q) employed
receivers, because of the simple f
that circuits of very high (Q) a
used to attain the highest degree
sensitivity and selectivity. This r
sults in sideband cutting, high n
attenuation, and loss of tonal color

(Q) equivalents may therefore
extended to include band-width a
selectivity.

Unfortunately, efforts are contin
ally being made to further raise t
quantity of (Q) by employing spec
designs in iron cored coils. This
a step farther away from fideli
The fact that claims have been ma
on behalf of iron cored coils th
they "peak up" should suffice
warn fidelity enthusiasts.

From the fidelity point of view t
air cored coil has no rival. Enthu
asts do at times claim good respon
for their receivers, since the poi
had been proved by making respon
measurements, in which a series
successive single audio frequenc
were applied to modulate a tra
mitter and thus enable the receiv
response to be determined.

ACTUAL CASES

In practice, however, such thin
simply do not happen during
broadcast performance when en
mous numbers of simultaneous fr
quencies are transmitted.

In earlier paragraphs referen
was made to the relative powers
different audio frequencies of sour
The low frequencies develop most
the power.

They effectively drive the hi
(Q) circuit currents to higher amp

(Continued on Page 85)

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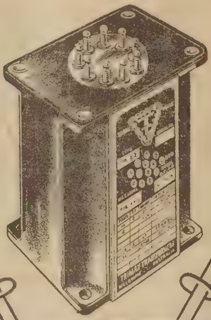

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PROBLEMS OF HUM AND NOISE

In the design of high gain audio equipment, one of the chief problems is the elimination of residual hum and noise. This article examines some causes of the trouble and suggests effective methods of treatment.

HOME constructors commonly encounter the hum problem in microphone pre-amplifiers and in pick-up equalising stages. At first glance, these may appear to present two different problems, as the nominal gain of a pre-amplifier (at middle frequencies) will be many times that of an equaliser-amplifier. In practice, the problem is the same for either stage for, although the gain of the equaliser stage may be only from unity to three or four times at middle frequencies, it will approach the gain of a microphone amplifier at 50 cycles, where the full bass boost is operative.

It can be seen, therefore, that the problem is fundamentally the same in both cases, as hum troubles occur at 50 or 100 cycles.

Lest some of the precautions and suggestions appear trivial, it is enlightening to consider the order of the input voltages involved—in particular, the hum injection voltage at the input grid necessary to give an objectionable background from the speaker.

It might be considered that peak output power of 5 watts is adequate for all normal domestic purposes, assuming that a loudspeaker with ordinary electro-acoustical efficiency is used.

TYPICAL CASE

Consider, as an example, the case of the "Amplifier for Lightweights" which was described in the July, 1949, issue of Radio and Hobbies. This amplifier is capable of delivering an output of approximately 5 watts with an input signal of 100 millivolts (0.1 volt) at middle frequencies. It has a compensator stage which provides 14 db of bass boost at 50 cycles and also a variable bass boost control which can provide a further 12 db of boost at 50 cycles.

Therefore, the input signal required for full output at 50 cycles with full bass boost is only about 5 millivolts (.005 volt).

If the noise level is to be 60 db below this, not an extremely good figure, the hum voltage at the input terminals must not exceed 5 microvolts (.000005 volt). In more sensitive amplifiers, this voltage would be considerably less, as also would be the case if the hum level had to be reduced more than 60 db below the suggested 5-watt reference level.

It is actually possible to make amplifiers in which the hum and noise level is 100 to 120 db below an output of 50 milliwatts if extreme care is taken.

Without laboring the point, it is obvious from the above figures that the voltages involved when dealing with hum are very low indeed, and special treatment is required to reduce stray coupling and leakage to an absolute minimum.

by Derrick Williamson

Perhaps the most obvious cause of hum in a preliminary stage is actually inadequate filtering of the plate (and screen) supply. It is also the simplest to remedy, since all that is required is normally the provision of more liberal decoupling of the high tension feed line.

In general, a decoupling resistor "R" of about 20,000 ohms and an 8 mfd electrolytic "C" will have the necessary effect. In extreme cases, the condenser value can be doubled and the resistor increased, if need be, to even as high as 0.1 meg.

The point about plate circuit filte ing is that the gain available amplify any ripple voltage is on that of the amplifier circuits follov ing the plate. It does not invol the gain of the pre-amplifier sta itself. There is some additional gai of course, from the screen circu in the case of a pentode pre-ampl fier, but residual ripple is furth reduced by the normal screen supp and bypass components, so that it not likely to be a problem.

It is possible to make a simp test, with normal circuitry, whi will prove definitely whether pow supply hum is causing any troub While listening carefully to the hu level, with the gain well advance make and break the circuit betwe the high tension line and the d coupling resistor. The decoupli condenser will supply volts to t pre-amplifier for a few seconds, a it will be immediately obvio whether disconnecting the tube alt gether from the power line eliminat the hum.

OBVIOUS CONCLUSION

If the hum persists in the fe seconds that the valve is operati without such a connection, it is obv ous that no additional amount high tension filtering to the sta can have any beneficial effect.

As we have pointed out on ma occasions, the mechanical constru tion and wiring methods in an a plifier can have a vital bearing the problem.

The electrical ideal, in high ga equipment, is to separate physical the power supply and the preamp fier stage, placing the two on di ferent chassis. The amplifier prop can be grouped with either one, a cording to requirements. While th is common practice in studio equi ment, it is not always convenient portable or domestic amplifie where single chassis construction preferred.

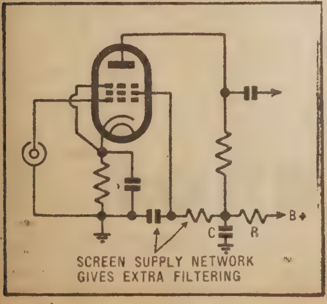
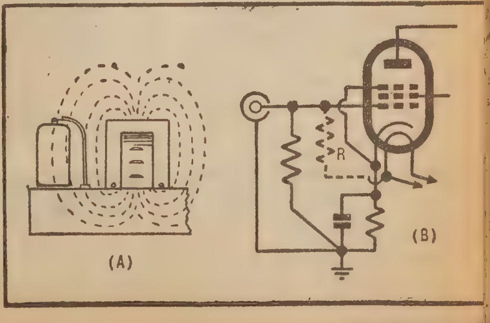


Figure 1. (left) Decoupling components R and C give required extra H.T. filtering.

Figure 2. (right) Illustrating (A) how magnetic fields induce voltages in long leads and electrode structures. (B) leakage between heater and grid.



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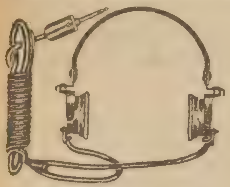

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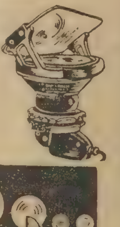

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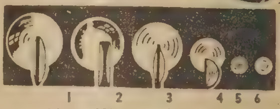

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In this latter case, it is essential to plan the location beforehand for the preamplifier stage (and associated components), making sure to keep it as far as possible from the power transformer and, to a lesser extent, the filter chokes. Good separation removes the valve from the most intense eddy current fields in the chassis and simplifies the problem of keeping the resultant voltages out of the input circuit.

Another point, which is not always appreciated, is that lines of force from the transformer can influence directly the flow of electrons in the valve structure and produce hum as a result.

TRANSFORMER TYPE

In general, a vertically-mounted power transformer gives much less trouble with eddy currents and stray fields than the horizontally-mounted type, which places the laminations in parallel with a section of the chassis.

CURING HEATER CIRCUIT HUM

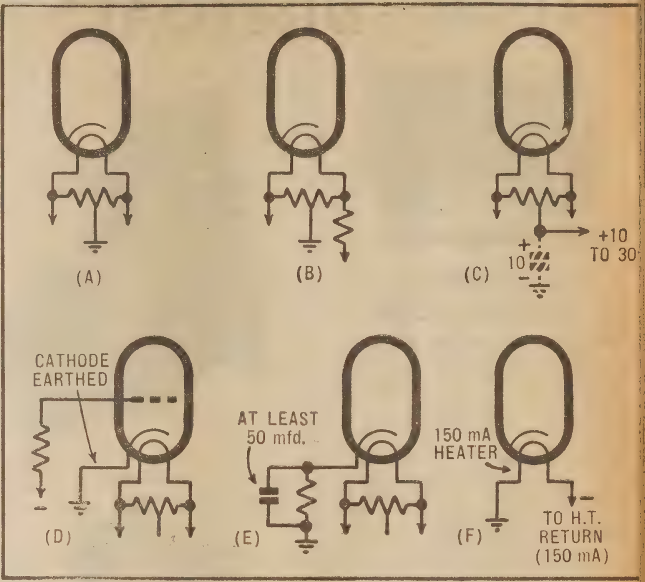

Figure 3. (A) Centre-tapped heater (B) Reduced heater voltage (C) Positive heater return (D) Use of grid leak, battery or back bias (E) Large cathode bypass (F) D-C supply from H.T. circuit.

Where an input transformer is involved, as for certain pickups, microphones and line applications, it is very difficult to instal the input transformer on the same chassis as the power equipment. With the simpler, unshielded types, it is indeed virtually impossible without paying the penalty of a noticeable residual hum.

Some input transformers of the very expensive type have double and triple shielding and a special winding arrangement which largely obviated trouble from external magnetic fields. Even with these, however, it is sometimes necessary to experiment with the mounting position to obtain complete freedom from hum. One particular type has provision in the mounting to rotate the transformer on the chassis, after the unit is put into service.

As a rule, such transformers are seen only in association with expensive equipment. The home constructor, obliged to use an unshielded input transformer in a preamplifier grid circuit, must either adopt the two-chassis technique or "hang" the transformer at a convenient spot in the input lead several feet from the power equipment.

WIRING METHODS

The next point to consider is the wiring methods employed. All heater wiring should be tightly twisted together and, in some cases, it is advantageous to run the heaters in twin-shielded wire, to reduce capacative coupling to other leads. If the heater is shielded the wiring should be enclosed in spaghetti tubing and the shielding earthed at one end only.

Heater wiring, even if shielded, should be kept well away from all grid and plate leads, as magnetic coupling can still occur between them.

It is essential to adopt the single point earth system in the construction of a high gain amplifier stage, otherwise eddy current effects in the chassis can produce a very high hum level.

This principle of a single point earth should be rigidly adhered to, even if it means the provision of insulated anchor points for some of the components.

The best method of determining the earth point is initially to insulate all the normal earth returns from the chassis then connect them together with a piece of insulated wire. The "quietest" earth point on the chassis can be found by experiment. In some cases the return point will have to be at the input connector if this is a type where one side of the circuit is automatically earthed.

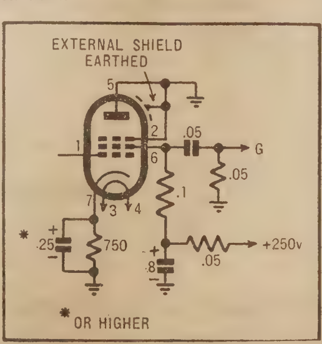

Figure 4. A novel method of operating the 6AU6 miniature pentode, giving good gain with low noise and hum content.

As a general rule, it is wise to u a shielded type plug and socket f the input circuit, rather than termi als or an open headphone jack. high impedance circuits particular a couple of inches of unshield connector can cause a lot of troub While special microphone type co nectors are very expensive, a lot disposals equipment has carried Bri ish "Pye" coaxial connectors, whi are quite good for the purpose.

Some designers, less troubled expense, prefer to use shield double-circuit input plugs and socke which allow both sides of the inp wiring to be kept initially abo earth. The return can then be ma to a convenient point on the chass possibly near the valve cathode p

CONNECTING LEADS

While on the subject of earth r turns, a special case arises where external preamplifier or compensa ing stage is connected to an amplifi which also supplies the filament a high tension power. Unless care taken, considerable hum can be i jected into the second grid circu by way of the earth links between t two chassis.

The heater of the remote val should preferably be operated from centre-tapped supply on the ma amplifier and be not connected to t preamplifier chassis. As a result, heater current will flow through t earth bonds.

If, on the other hand, one si of the heated wiring is earthed bo in the preamplifier and the ma chassis, a proportion of the heat current will flow through each the earth return leads to produce voltage drop, which must natural appear in the coupling to the ma amplifier.

Even if the heater circuit is su

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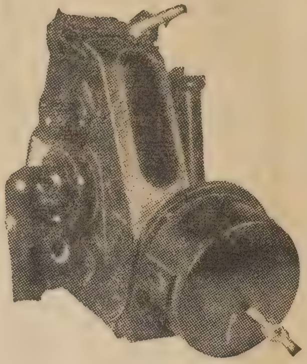

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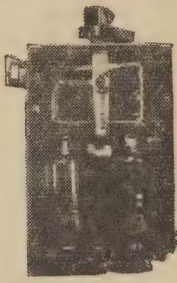

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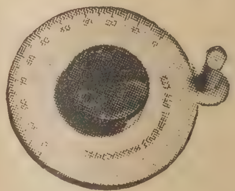

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ably arranged, care must be taken with the negative H.T. return, which is normally made through a power plug and socket on the main chassis. It will generally be found desirable to earth this return in the main chassis right back to the earth point for the preamplifier stage.

If this precaution is not taken, a proportion of the voltage due to eddy current in the main chassis is likely to appear in the coupling circuit, with a consequent increase in hum level.

Always provide a negative H.T. return wire in addition to the shielded connecting lead, even if it does appear to duplicate the earth wiring. At least it will save you a nasty shock from the potential, which can build up between the chassis if the earth return circuit is not completed simultaneously with the H.T. path.

VALVE TYPES

And now we come to the hum which originates in and around the socket and valve.

Up to the present time, one of the best preamplifiers for general P.A. work has been the 6J7-G pentode. This valve has the grid brought out to the top cap which provides excellent isolation from the heater wiring. However, this lead must be shielded and kept clear, by proper layout, from magnetic fields surrounding the power transformer.

For special purposes a non-microphonic version of the 6J7-G, type 6J7G/1620, is available, and this is particularly useful where the amplifier is mounted near the speakers, or is subject to vibration.

Recent experience suggests that the single-ended 6SJ7-GT is not as good a pre-amplifier as the older type, although it is admittedly smaller and up-to-date. It appears to be more noisy in operation and many samples show microphonic tendencies.

The single ended construction also has the disadvantage of the heater being much closer to the grid pin than when the top cap type is used. Leakage across the valve socket and also the valve base itself can cause serious hum.

A recent article in "Radiotronics" points out that if the resistance of the socket and base alone were the cause of the hum, and the grid circuit impedance was 0.1 megohm,, then a leakage of 50,000 megohms would be sufficient to cause a hum level 60 db below full output. This figure is calculated for an amplifier such as the "Amplifier for Lightweights," in which the signal input at 50 cycles for full output is 5 millivolts (.005 volt).

D-C LEAKAGE

This does not take into account hum caused by capacitive and inductive coupling.

Obviously, then, the hum problem can be accentuated by over-generous application of soldering paste, by moisture and by dust. A high quality mica filled bakelite or ceramic socket may also be an advantage, although, under these conditions, the limit is likely to be set by the bakelite valve base itself.

From the point of view of low leakage resistance between valve pins the new all-glass miniature valves are a logical choice. On several occasions recently we have used the miniature type 6AU6 as a pre-amplifier with great success.

This valve gives higher gain than the 6SJ7-GT, but is less noisy and microphonic. Its small size also makes the task of shock mounting very easy, if this should be necessary. Miniature valve sockets, moulded from high grade mica-filled bakelite and complete with valve shield, are available, and, if the soldering &c, is carefully carried out, leakage across the socket can be reduced to a minimum.

HTR—CATHODE EMISSION

The next problem is emission within the valve itself between the cathods and heater and this is a problem common to all types.

The effect is most disconcerting, as some valves give no trouble at all while other valves are very bad. It is not uncommon to find that, after replacing a valve in an amplifier with a new one, quite a severe hum has developed, apparently due to this cause. The same valve will usually operate without any sign of hum in a stage working at a higher level. Furthermore, this hum will sometimes build up gradually during service, as a valve ages.

Trouble of this nature was experienced in the small recording amplifier described recently by the writer. Several weeks after the issue containing the description of the recorder had gone to press, it was noticed that the amplifier had developed a hum which was finally traced to the heater circuit of the 6AU6.

I must admit to having broken a cardinal law in that one side of the heater circuit was earthed, rather than the centre-tap, but I had an idea in mind at the time regarding a couple of cueing lights, operating from the same winding. Whether a properly centre-tapped heater system would have stopped the hum is, of course, a moot point.

Not wishing to make drastic wiring changes, I resorted to another old trick for reducing hum, that of reducing the heater voltage and temperature. A 10 ohm 3-watt resistor was duly connected in series with the heater lead to the 6AU6 only, and

(Continued on Page 99)

6AU6 AS GROUNDED PLATE TRIODE

Typical Conditions

Plate Volts—300			
RL (Megohms)	0.05	0.1	0.25
RK (Ohms	230	450	1000
Ib (mA)	4.3	2.35	1.0
Stage gain	25	25	23
Plate Volts—180			
RL (Megohms)	0.05	0.1	0.25
RK (Ohms)	450	750	1600
Ib (mA)	2.4	1.3	0.59
Stage gain	21	23	21
RL (Megohms)	0.05	0.1	0.25
RK (Ohms)	1100	2000	4000
Ib (mA)	0.93	0.54	0.25
Stage gain*	14	14	13

* Resistance of following grid leak equals 0.5 megohm.

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COURSE IN TELEVISION

PART 14—THE D-C COMPONENT

Students of television soon become aware of frequent references to the d-c component and to d-c restorers. What is meant by these terms, which have no obvious counterpart in sound broadcasting? This article talks about the d-c component generally in relation both to automatic volume control and to video-picture tube circuits.

O understand the importance of the d-c component in a television ıal, it is necessary to understand character of the signals and the y in which they differ from AM nd signals.

ın AM sound carrier has a cer- ı unmodulated amplitude which y be represented as in figure 1a. carrier is received at the aerial ninals, amplified by the RF and stages and then impressed on the ector. Here it produces a steady measurable voltage across the ector load and this varies only en fading or other like circumıce causes a variation in the ngth of the input signal.

Vhen the carrier is modulated, effect is as shown in figure 1b, carrier amplitude alternately ng and falling at an audio frency rate in sympathy with the nd content being radiated. The ıificant feature is that the carrier ursions are symmetrical in nature, eriodic rise in amplitude being owed immediately afterwards by equivalent decrease in amplitude. average amplitude over the full le of modulation remains conıt.

NDITION HOLDS

'his holds true, irrespective of ether the modulation is a simple wave pattern or a complex ture of sine waves representing the fundamentals and harmonics duced by a complete orchestra.

ı the case of the popular diode, incoming signal produces a age of a negative sense with respect to earth across the diode load. The voltage is constant for a steady unmodulated carrier, but varies symmetrically about the steady value when the carrier is modulated.

By applying this voltage to a resistor and a condenser combination having a long time constant—1.0 meg. and .05 mfd. are common values—the audio variations are eliminated and a steady d-c voltage becomes available to control the gain of the preceding stages. (The fact that a separate AVC diode may be used for this purpose in many receivers does not alter the sense of the argument).

The AVC voltage so produced is governed by the average amplitude of the modulated envelope, which is substantially equal to the unmodulated value. This relationship between a normal AVC voltage and the average carrier amplitude is an important one to remember.

As far as the audio component is concerned, this is normally coupled through a condenser to the following amplifier valve and the sound intensity rises and falls according to the loudness of the original performance and the setting of the receiver's volume control. There is no vital relationship between the d-c effects produced by the carrier in the detector circuit and the audio component.

T.V. MODULATION

A television signal, however, is fundamentally quite different in character. As we have already seen, the carrier has no natural or mean unmodulated value, nor is the modulation symmetrical in character.

With negative modulation, the peak carrier amplitude is set by the line and framing pulses, which may be illustrated as in figure 2. The space in between the pulses is occupied by signals which represent the intelligence of the picture, while the carrier amplitude in between the pulses depends entirely on the nature of the picture traced by the scanning line.

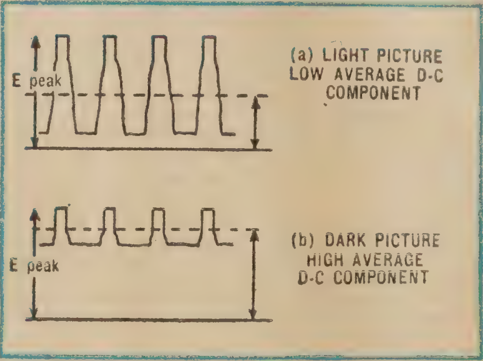
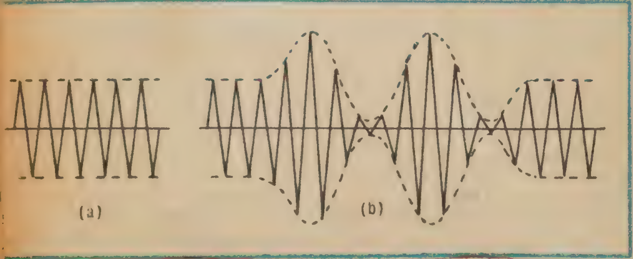


Fig. 2. The average value of a television signal and its d-c effect at the detector depends on the modulation characteristic produced by the picture.

Still assuming negative modulation, light portions of a picture represent minimum carrier amplitude. Thus, if the video camera showed a figure disappearing into a snowstorm, there would be very little residual modulation between the pulse peaks.



igure 1. An unmodulated (a) and a modulated (b) sound carrier wave. Note the mmetry of the modulation wave form, an important difference from a television signal.

On the other hand, a night scene, with the resultant heavy modula-

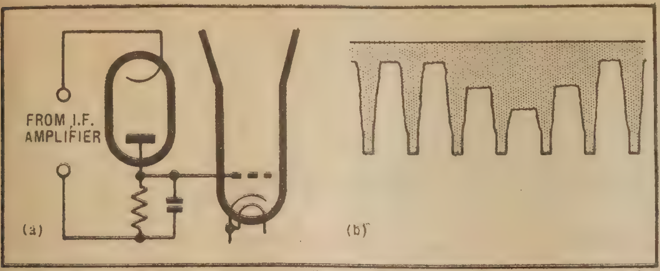


Figure 3. Direct coupling between the detector for video stages and the picture tube (a) passes the d-c as well as the a-c component maintaining the pulse peaks at a constant amplitude.

tion, would largely fill the inter-pulse spaces up to the signal modulation limit of 75 per cent, or thereabouts.

If the two sets of signals were to be applied to a conventional detector, the voltage built up across the load and across the AVC circuit would be higher with the night scene than with the snow scene, due to the increased average carrier amplitude. In other words, the d-c component across the detector load would be higher in the one case than the other.

Referred to the AVC system, this would mean a higher voltage and a greater gain reduction factor with dark scenes, causing a general lightening of the picture. Conversely, a light picture would bring about increased gain, due to AVC action, and a general darkening of the picture. In other words, the AVC circuit would have an "averaging" effect on picture brightness, thereby defeating, in part, the dramatic value of varying light intensity.

This is obviously undesirable, and the type of AVC circuit commonly fitted to broadcast receivers is far from the ideal in a television set.

A.V.C. REFERENCE

The requirement is rather to derive a gain control voltage which is proportional to some constant aspect of the television carrier and this can be either the blanking (or "black") level or the peak amplitude of the timing pulses, assuming negative modulation.

Once having derived a gain control voltage truly proportional to peak amplitude, only a variation in effective carrier strength or some circumstance at the receiving end can cause a variation in the control voltage. The picture content can change from one extreme to the other without affecting receiver gain at all.

With a system using positive modulation, the position is exactly reversed. The timing pulses occupy the initial 30-odd per cent of the modulation capacity, the "black" region lying immediately above this. Increasing degrees of picture brightness expand the carrier to its full "100 per cent" value.

Once again, the only constant reference level in such a system is that set by the timing pulses and the "black" level, representing about 40 per cent in all of the modulation capacity. An AVC system would need to respond as far as possible to this base level only, and completely ignore the modulation peaks. Any response to these peaks would tend to lower the gain and reduce peak brightness, bringing about an "averaging" effect similar to that already outlined for negative modulation. These directly opposite requirements are worth noting.

In point of fact, the problem of AVC has not to date been an urgent one with positive modulation systems. Britain uses positive modulation but, since only one station is available to any group of listeners, the receivers can be pre-tuned and the gain normally adjusted. Within the normal service area, fading conditions are not likely to be encountered to any extent, the chief cause of varying receiver gain being variation in line voltage.

In America, on the other hand, there are a multiplicity of channels and programmes available, and AVC is just as important as in a sound-broadcasting service. Here, the negative modulation system presents no special difficulties in relation to the AVC circuit, apart from ensuring that the AVC generator is a peak acting device.

Australia has tentatively adopted negative modulation as standard, so that AVC problems will likewise not be serious. However, the need for AVC with only one or two stati available initially is very doubt Assuming that switch-tuning is us it would appear a very simple mat to select pre-set gain positions at same time, and thus simplify general circuitry.

The d-c component is again i portant in the video coupling circu between the detector and the cont (or intensity) grid of the pict tube. The remark applies irrespect of whether video stages are used not, although, for the sake of ill tration, it is simpler to consider direct feed from the detector out to the picture tube control grid.

Figure 3a illustrates a direct c nection between the diode load the control grid. An increase in c rier amplitude will produce a ris negative voltage across the lo thereby decreasing the intensity the picture spot. This happens correspond to the requirements negative modulation.

DIRECT COUPLING

The special point about this di coupling—a familiar term—is tha passes on the d-c as well as the component of the signal. As the c rier amplitude varies with modu tion, the detector produces a se of pulses which are all negat with respect to earth, or the load turn point, as the case may be.

The timing pulses have a const peak amplitude with respect to ea and the modulation voltages appl to the picture tube grid are prop tional at all times to the car amplitude (Figure 3b).

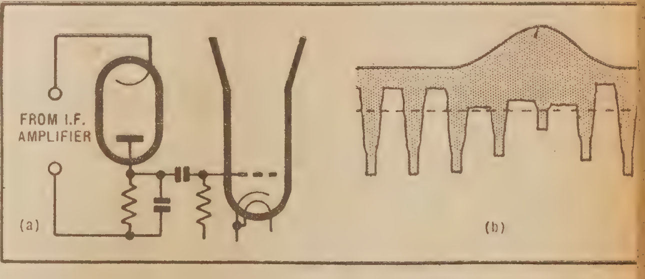
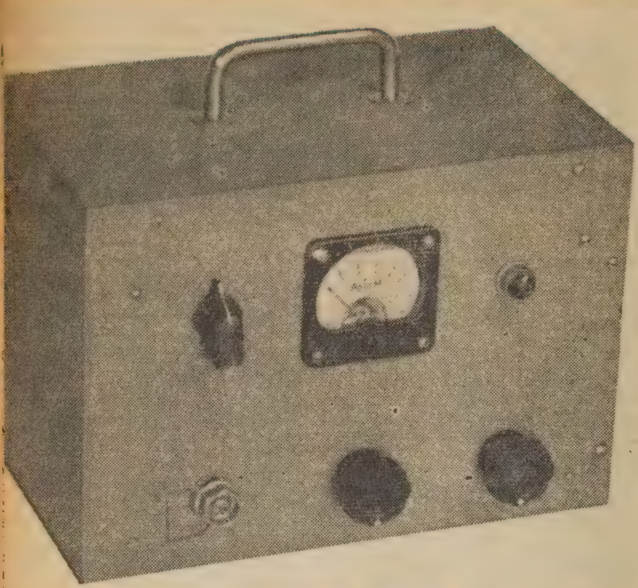


Figure 4. The general effect of R/C coupling (a) is illustrated at (b). The a- signal is retained, but the d-c base reference is lost. D-C restoration becomes essentia

If, however, a resistance-capacitance coupling network is inse between the detector output and grid, operation of the circuit is f damentally changed. The series uni-directional pulses produced the detector build up an additic charge across the coupling conder and apply a virtual bias to the c trolled electrode. This bias va according to the modulation cont and takes up an average value s that the original uni-directic pulses are changed into negative positive pulses around a rather determinate mean level.

The effect imparts an aver greyness to the picture, preven

(Continued on Page 89.)



The instrument mounted in [illegible] case. The [illegible] terminal is [illegible] the lower [illegible] corner. Otherwise the [illegible] is the same as for the [illegible] version.

IOISE GENERATOR FOR V.H.F.

In last month's issue we gave details of a simple, effective and versatile diode noise generator. The instrument delivers a steady, controllable noise signal which can be used for making measurements of receiver noise factor. This present article discusses the method of making measurements in more detail and the requirements for work in the V.H.F. range.

NCE describing the instrument in the June issue, we have had the ortunity to conduct some experi- ıts with a number of receivers in laboratory and have been duly ressed with the value of noise erator technique in general.

nall adjustments to aerial coup- and input circuits generally ch were not noticeable orally, ame quite obvious when observed ı the aid of the generator. The ı of several small adjustments ame equally obvious to the ear n listening tests on the air were le.

lost of the receivers available designed for 72 ohm coaxial ler but the versatility of the in- ment became apparent when we :led a 50 mc receiver with 300 ınced input.

was simply a matter of remov- the shorting plug and changing load resistors and we were ready o ahead.

s you will remember, the gener- is provided with two coaxial ıectors from which it is possible obtain either balanced or un- nced output. The noise voltages erated by the diode appear veen the filament and plate and equal load resistances are connected from both plate and filament to earth.

As far as the high frequency noise voltages are concerned the centre terminals of the coaxial connectors are connected directly to the plate and filament of the diode respectively. Therefore, the noise voltages appearing at the centre terminals of the connectors are opposite in phase and equal in amplitude.

The balanced output may be fed into any balanced line such as the 75, 150 or 300 ohm ribbon by means of a pair of small clips.

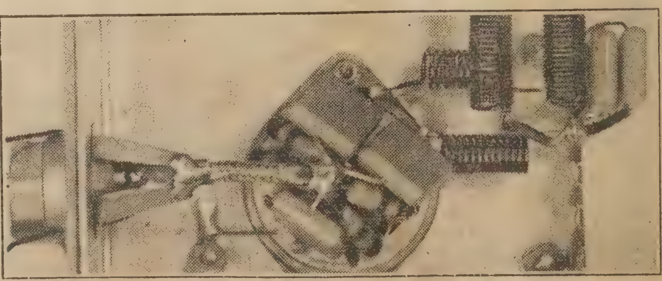
If, however, the lower load resistor is shorted by means of a shorted coaxial plug, the upper resistor will become the load for the noise voltages and unbalanced output may be obtained from the upper coaxial plug.

In order to simulate the condition when the receiver is connected to a correctly matched aerial, a load resistance equal to the impedance of the line being used is included.

While it would be possible to include a switch to change the load resistances, the additional capacitance and inductance introduced by the switch would seriously limit the upper frequency at which the instrument is accurate and, further, the highest frequency at which output can be obtained would be lowered.

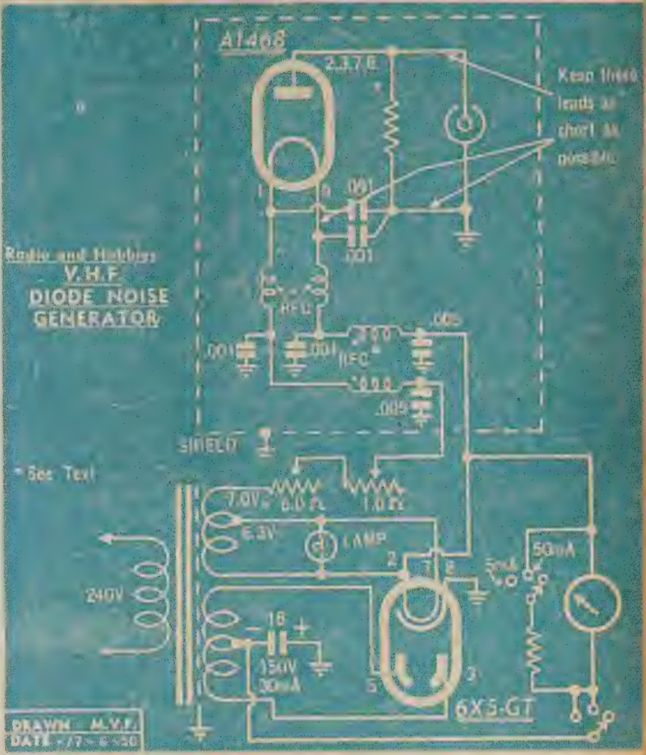
Therefore, we suggest that the resistors be soldered into place with short leads and changed with the aid of a soldering iron when it is necessary to make measurements on receivers with differing input requirements.

The resistors should have a minimum of inductance. Small ½ or ¼ watt carbon types are suitable. Some low value resistors with moulded bakelite bodies are actually wire wound, so check this point carefully.



A close up photograph showing the layout of [illegible] around the diode socket. The [illegible] is [illegible] from the panel to the [illegible] socket. Every effort is made to reduce stray inductance and capacities to a minimum.

GENERATOR FOR V.H.F. TESTS



The single ended output circuit permits very short leads, As a convenience wl taking measurements, we have included a three position function switch. In first position, the high tension supply is disconnected while in the second and thir positions the meter reads 50 mA. and 5mA. respectively.

As far as we know, the lowest value of non-inductive resistor is 200 ohms and it may be necessary to parallel two or more to get the required value.

The readings of noise factor will be accurate provided that the frequency at which the receiver is being tested is well below the "limit" frequency of the generator. The limit frequency is determined by the valve and circuit capacitances and the inductance in the connecting leads.

Under ideal conditions with the A1468, usable output should be obtainable at 300 mcs. The upper frequency at which noise factor readings can be considered accurate is difficult to determine. However, it would probably be fairly safe to assume that readings up to about 150 mcs are fairly accurate provided the instrument is constructed with reasonable care.

COAXIAL OUTPUT

By sacrificing the convenience of balanced output, it is possible to make a worthwhile reduction in the inductance and shunt capacitance and increase the upper frequency to which the instrument is useful. This is what we have done in the circuit published here. We suggest this circuit where measurements above 100mcs are the main consideration.

Although not theoretically correct, it has been found in practice that the single ended output works quite well with a balanced line and useful measurements may be made.

Actually, it is rarely necessary for absolute measurements of noise factor to be made. In most cases, all that is necessary is to be able to determine whether or not an improvement has been made after completing an adjustment.

To take a reading of noise factor, the generator is connected to the receiver through a cable of the correct impedance.

Make any adjustments to the load resistor which may be necessary.

A meter which reads power or the readings of which are capable of being interpreted in terms of power, is connected to the output circuit of the receiver and the gain is adjusted until the meter reads some convenient figure of noise power. At this point the receiver must be delivering less than half of its available power.

The generator is then turned on and the plate current adjusted by means of the filament rheostats until the noise power output of the receiver is doubled. Make sure that the output is well below the overload point.

VOLTAGE READING

An AC voltmeter may be used in which case double power output will increase the reading 1.41 times. For example, if the reading on receiver noise is adjusted to 100 volts, noise output from the generator will be required to increase the output voltage to 141 to obtain the required 1 to 2 power output increase.

*Incidentally, we would suggest using lower figures than this when dealing with a set with a conventional single output tube, since the power involved with 140 volts developed across 5000 ohms is almost 4 watts.

There is no need to work out the figure each time a measurement is taken. Simply note that the receiver requires a certain diode current to double the noise power output and continue adjustments until the smallest possible current is required. You may then substitute in the formula if you wish.

When taking these readings you will probably notice that both meters and particularly the meter reading the diode current are far from steady. This is mainly due to the fact that the diode plate current is very critical to changes in filament temperature. As may easily be checked, even the switching on and off of a light will cause a noticeable change in plate current. Each time a reading is taken it is necessary to observe the needle for a few seconds to establish an average.

As a matter of interest, we have included a graph showing plate current as a function of plate voltage for various filament voltages. The graph refers to a typical temperature limited diode. Note that increasing the filament voltage from 5.5 volts to 7.0 volts changes the satura plate current from 8 mA. to 50 m

Subject to the limitations alre discussed, it is possible to arriv the noise factor of the receive db. from the formula:

Fn = 10 x log. 20 x I x

where, Fn = noise factor in db.
I = diode current in a
R = load resistance in o

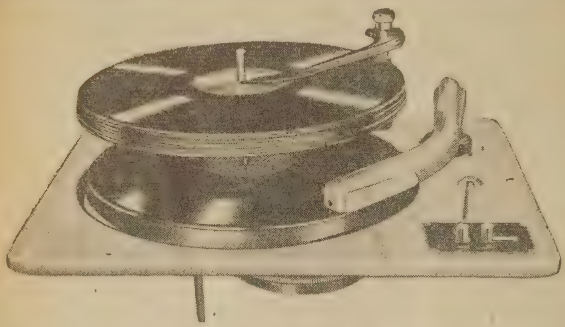
FORMULA

The constant 20 in the equati an approximation of a numbe physical constants and assumes the readings are taken at normal t peratures. The factor 10 x lo included to conver the power to db.

Since the bandwidth of the rece with respect to noise generated in input circuits and that introduce the diode generator is the same, bandwidth does not appear in equation. The noise factor is sin a comparison between a perfect ceiver and the receiver under A perfect receiver has a noise fa of O db.

We have published a chart b on this formula and which ena the noise figure to be arrived a w

two of the best . . .



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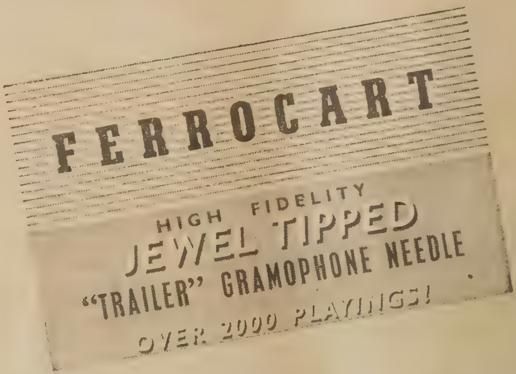

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out the necessity for consulting log tables, &c.

With this second version of the diode noise generator we have arranged the circuit to make full use of the capabilities of the A1468 at high frequencies. The leads from the plate to the centre conductor of the cable must be as short as possible. The same applies to the condensers returning the filament circuit to the outside conductor of the cable. The leads should be very little longer than the condensers themselves.

At the same time, every effort is made to reduce the capacitance in shunt with the valve to the lowest possible figure.

The photograph illustrates how we have arranged the components to this end. A short length of small co-axial cable is run from the back of the co-axial connector to a point over the valve socket. The centre conductor is extended past the outer braid only sufficient to allow a solder joint.

CONSTRUCTION

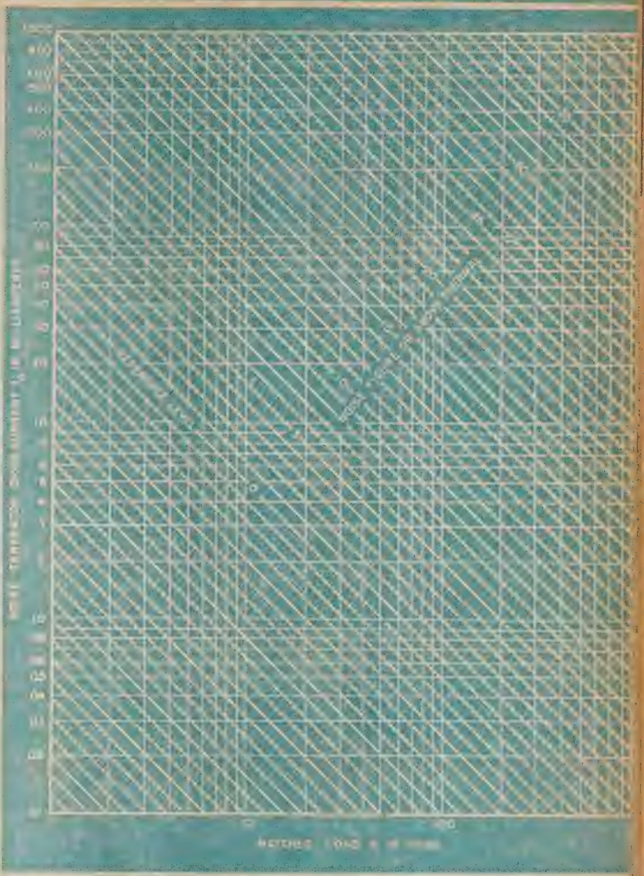
In order to break the continuity of the cable as little as possible, four strips of tinplate are soldered between the outer braid of the cable and the locknut of the connecter. Actually, we found it convenient to do this by making a star-shaped washer and bending the points over so that they enclose the centre conductor.

Solder as close as possible to the end of the outer braid. If you bind the outer conductor with a length of fine tinned copper wire it will be much easier to make an effective joint without mutilating the cable.

Cut the cable so that the other end is over the earthing spigot of the valve and solder four heavy leads from pins, 2, 3, 7 and 8 to the centre conductor. The leads can be made short if the socket lugs are bent slightly toward the centre. The purpose of the four connections is, of course, to reduce the inductance of the plate lead.

Incidentally, some of the 9 pin lock-in type sockets have a fairly high capacitance to earth. After examining a number of sockets we picked a ceramic type, which happened to come from disposals equipment, as most suitable. Do not use a close-fitting valve shield, as the valve has a fairly massive plate to dissipate heat.

CHART GIVES NOISE FIGURE



The noise figure of a receiver can be determined with the aid of this chart witho the necessity for consulting log. tables. The chart assumes that the noise power outp of the receiver is doubled by the output of the generator. (Chart courte "Electronics.")

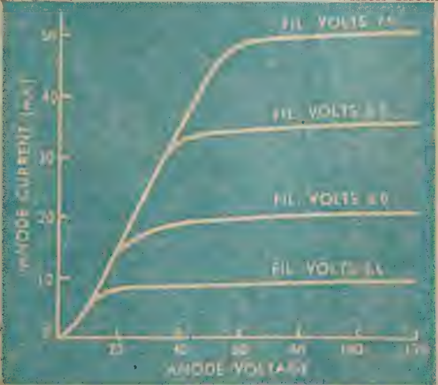


Plate characteristics of a tungsten filament diode plotted for various filament voltages. Note that, after saturation has taken place, the plate voltage has very little effect on the plate current.

The load resistors are soldered from the plate lugs on the socket to the outer braid of the cable. This point, which should be as close as possible to the end, is considered as the earth point for the system with regard to R.F. noise currents. It is returned to earth for supply current via the outer braid of the cable.

Since 200 ohms is the lowest value carbon resistor available, we used four ohm ½-watt resistors connected parallel. The only possible de mental effect from this arrar ment is a very slight increase in shunt capacitance.

The .001 mfd. filament bypass densers are returned to the earth point and, as you can see the photograph, there are virtuall connecting leads.

The tensioning spring at the ce of the filament inside the valve is nected to pin 5. Data on the A specifies that this pin should no used, but we can see no objectio connecting a small bypass conde from this pin to earth to further duce the inductance in the return cuit. Our generator, therefore, cludes a .001 mfd. condenser from 5 to the earth point, although it is shown on the circuit.

Chokes are required in the filan

STC

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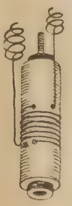

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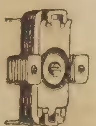

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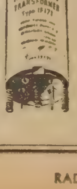

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circuit to prevent extraneous noise voltage or signal from reaching the output socket. They consist of 15 turns of 22 SWG wire ¼in diameter, spaced ¾in in the case of the chokes nearer the filament and 40 turns of 22 SWG also ¼in diameter in the case of the larger chokes. The chokes are not particularly critical as they are not required to act as a load for the signal.

NOISE FACTORS

Experimenters will probably be interested to learn what is considered a good noise factor for a receiver. Naturally, the goodness of a receiver decreases with increase in frequency, but 5 db. is considered a good value at 50 mc. On the 144 mc. amateur band a receiver with a noise factor of about 7 db. would be considered excellent. We believe that noise factors as low as 3 db. have been obtained at a frequency of 30 mcs.

Optimistic readings at high frequencies are possibly due to a resonance effect. It appears that the valve and stray capacitance, together with the lead inductance, form a series resonant circuit. The noise voltage appearing across the load resistance is increased by the Q factor of the circuit and greater noise power is fed into the receiver.

We carried out some experiments at 250 mcs. and found that if length of lead between the diode plate and co-axial cable was added and pruned it was possible to produce a reading optimistic by about 10 db.

At frequencies above about 300 mcs. the limitations of the valve itself rather than the external circuit become a major consideration governing the accuracy of the instrument. To extend the accuracy of the instrument above a frequency of this order, it would appear necessary to construct the diode in the form of a concentric transmission line terminated at one end with its characteristic impedance and the other end feeding into co-axial cable.

TRANSIT TIME

The limiting factor in this case would be the electron transit time and the co-axial cable's characteristics. Reduction in electron transit time can be achieved by increasing the plate voltage and by decreasing the inside diameter of the diode plate, at the same time as the filament diameter to retain the required impedance. The limit of this technique is reached when the filament becomes too thin to have practical strength and/or the plate to filament spacing is low enough to permit a high-tension flashover.

Although it is still in the laboratory stage, noise factor technique for measuring receiver performance at centimetre wavelengths has been developed. A great deal of research along these lines has yet to be carried out.

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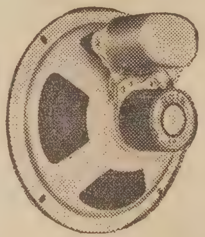

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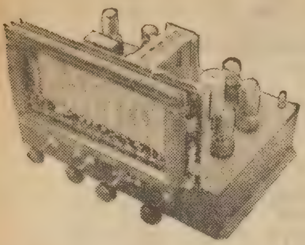

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FROM THE SERVICEMAN WHO TELLS

Every serviceman should have a system—in other words a series of cards or books which tell the history of service jobs, clients, income, expenditure and so on. It makes the income tax people a lot happier than they seem to be if you can't separate service fees from the grocer's bill. Finicky people these tax collectors!

AS an aspiring (and perspiring) contributor to Radio and Hobbies, I have an additional system dealing with items for possible inclusion in future issues.

The system involves jotting down experiences, dates, figures etc., on scraps of paper which are put aside for future reference.

A couple of days back I found some of these notes again, quite by accident, thus solving the mystery of where they all got to. Amongst the scraps was about six pages of script which I had written in an industrious moment and forgotten all about. The beginning of it reads like an introduction to a new article and there's even a reference to Christmas. I quote myself:—

SPECIAL JOBS

“Oddly enough, it seems that special job types arrive in batches—like scones! for a week or so, all the troubles seem to afflict the big combinations, whilst the following week all the midget sets in creation arrive on to the doorstep for service. I must admit, of course, that the ‘portable set week’ coincides with a public holiday. These sets are like week-end cars — nothing happens until the garages are closed.

“However, such was the case during the week following Christmas. Quite a number of battery sets appeared on the scene with minor and major faults.

“The first set was a rather new-looking imported portable which could be operated from either batteries or the a-c power mains. The owner's story was that whilst he was using the set on batteries, it suddenly ‘cut out.’ Thinking that the batteries were at fault, he connected it to the a-c mains. The set played for a few seconds and ‘cut out’ again.

IN AND OUT AGAIN

“My first action was to switch the set on. It played for a few seconds and then the stations just disappeared. The same thing happened when operated from the a-c mains. As the set still sounded ‘alive,’ my immediate impression was that the oscillator portion of the converter circuit was at fault.” So runs the story, anyway!

“By this time, I had the back cover off the cabinet. A check of the terminal voltage of the A-battery under load, and no-load conditions showed it to be well within its useful life. As a matter of form, the B batteries were checked also and found OK.

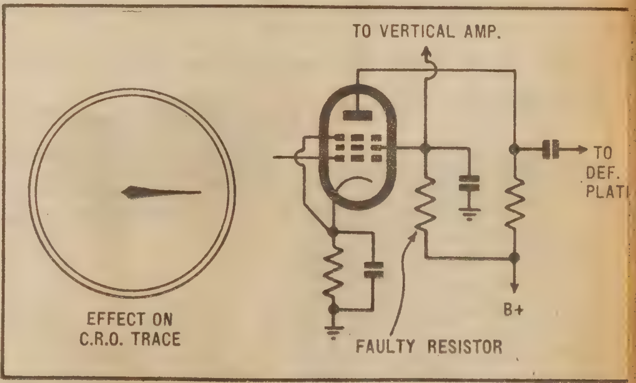
“However, my original suspicion was confirmed when I plugged the converter valve into the valve tester. An initial reading of about 70 per cent dropped, in a matter of seconds, to about 25 or 30 per cent. This happened every time that potential was applied to the electrodes, clearly an explanation of why the oscillator section dropped out of oscillation so easily. A new valve and the set played like a champion.

“The owner was taking a more optimistic view on life as he ambled away with his set “tooked oonderneath 'is arm.' His only query was why radio sets needed so many funny little gadgets under that ‘metal plate.’

“The second set was a personal portable, one of those things which are becoming as much a part of beach attire as a towel. The owner complained of the set not having enough volume. He said that he had purchased it second-hand and, while he appreciated that it was a small set, he felt that surely he should be able to listen to it more than a few inches from the speaker.

“I could only agree with him on this point while I removed the necessary covers to get at the torch-cell A battery. The battery was down, but hardly enough to account for the faint whispers of sound. The B batteries were OK, too, but I did notice that the aerial trimmer had been moved. Peaking this improved matters slightly.

“Again, however, the valve tester ‘paid for itself.’ A check showed that the output valve had co pletely ‘had it.’ I fitted a new va and, presto—the volume had to cut back. Another satisfied c tomer.”



An old fault in a new guise. An open circuited screen supply resistor affected th C.R.O. with the visual result indicated.

At this point, my story about po ables and Christmas week co to a full stop. Either I put the pap aside to listen to a Hassen or Sands effort, or else I've lost remainder of the sheets.

On the next couple of pag carefully pinned together, my lit ary efforts take off on anot course altogether. Once again quote myself but without the app priate marks fronting each pa graph.

TEST GEAR

Psychologically (that's a beau it's a good thing to lick custom radio troubles promptly and a items of test gear make a big ference in this respect. Someti the worm turns, however, or gremlins hit back, whichever you like it, and the test gear it gives trouble.

Such was the case when I swit ed on the CRO on my service be to deal with a public address sou system which needed prompt tention. Instead of the usual tr appearing on the screen, there a predominant spot with abou half inch of ‘tail.’ This was concerting to say the least.

I rotated the course freque control and noted that the sw of the ‘tail’ varied accordingly. first sight, the time base circuit OK. The next link in the chain the time base amplifier, a push- circuit. Here, with the aid of faithful,' the multimeter, it soon evident that there was no v age on the common screen line the amplifier valves.

Tracing the wiring back to HT feed point brought to light open-circuited screen dropping

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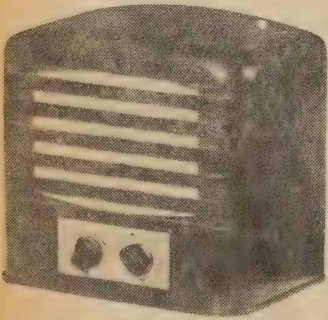

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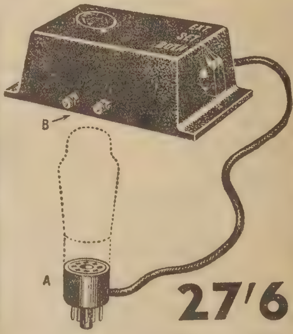

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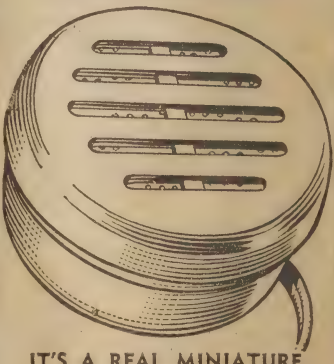

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sistor. The offending component soon found itself in the dustbin and a new one was wired in its place in the CRO. The time base trace was now its normal length on the screen and 'ready for duty.'

There's no moral in this simple story. It is merely to show that even test equipment can give up the ghost. In other words "who fixes the breakdown van when the breakdown van breaks down . . .?"

Now let's see what's next. Digging through the notes and papers is like resurrecting the family album. You come across all kinds of things you knew existed but had long since forgotten. Ah yes, I find a letter from a Celtic reader in Ladysmith, NSW.

A LETTER

"Dear Serviceman Who Tells,

"Would you like a bedtime story? Well, here it is. A client brought in a battery set the other day with the advice that he couldn't get any station above 2WG; it had been gradually dropping back over the past few weeks, and he thought it might finally run out around 2AY.

"The first thing I did was to test the converter which, strangely enough, showed up as 'good.' I then went over all the other valves and found them all likewise in order.

"After seeing that all batteries were in good condition, I got on to the I.F.'s. From being full on, the attenuator was gradually brought back to nearly half way. Very promising! The same applied to the trimmers. Now to the padder; got on to 600Kc, but all the screwing up and down would not even bring a whisper. (Who said "Whispering hope?")

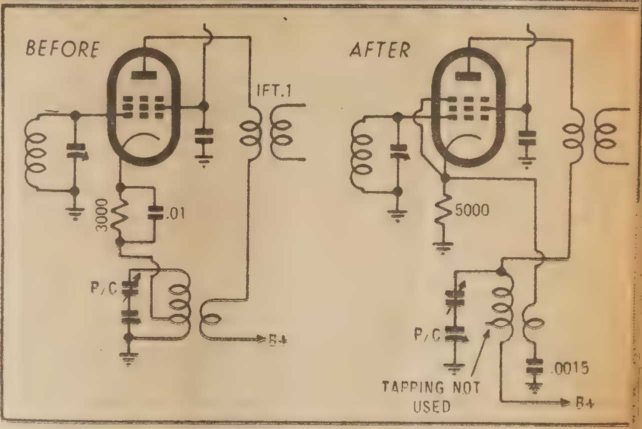
"I tried the set out again and could get as far as 2CY, but below that she just wouldn't play. I held the iron near the oscillator coil until it was pretty warm, still no difference on the L. F. end. Filled and lit the pipe whilst I gazed 'inter' the works. All voltages in order, also current and back bias. I had not tried the oscillator grid current at this stage; I just 'noo' it wasn't right.

PADDER FEEDBACK

"I was about to unsolder the grid resistor, but as the .1mfd condenser on the B plus end of the oscillator coil was much easier to get at, by one stroke of the iron I lifted the earthed end off and swung it across to the padder. After that a further run over the trimmers and the padder, and the client said, 'Better than ever she was, Mac.' The set has a R.F. stage with 2 1M5's one 1C7, 1K7 and 1L5. Total current drain right on 10 MA. How many have tried the little bit of padder feedback? For the uninitiated here is the circuit change on the oscillator coil. The dotted condenser was the original setting."

Many thanks Mr. McC. for your worthy contribution to these columns. To digress for a moment and become technical for once, the "stunt" of padder feedback is a very good one for servicemen to keep in mind.

A MODIFIED AUTODYNE CIRCUIT

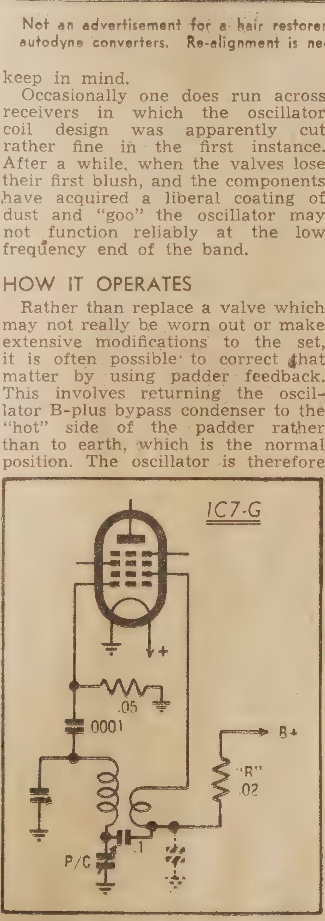


Not an advertisement for a hair restorer but a method of treatment for unreliab autodyne converters. Re-alignment is necessary after the changes have been mad

Occasionally one does run across receivers in which the oscillator coil design was apparently cut rather fine in the first instance. After a while, when the valves lose their first blush, and the components have acquired a liberal coating of dust and "goo" the oscillator may not function reliably at the low frequency end of the band.

HOW IT OPERATES

Rather than replace a valve which may not really be worn out or make extensive modifications to the set, it is often possible to correct that matter by using padder feedback. This involves returning the oscillator B-plus bypass condenser to the "hot" side of the padder rather than to earth, which is the normal position. The oscillator is therefore provided with a feedback ci additional to the coupling in coil itself.



A trick to keep converter valves going at the low frequency end. Switch the oscillator bypass to the "hot end" of the padder. Note the "R" must be present in circuit or a substitute R.F. choke.

For the circuit to be effec there must be a series res between the oscillator coil and B-plus line, otherwise the circu gets tangled up with the B- bypass. In most cases the oscil is supplied through a series res and the difficulty does not ari

If, on the other hand, the o lator operates directly from B-plus line or a battery tappin is possible to insert an R.F. c in the feedline and install a by between the B-plus point on coil and the "hot" side of the der. But enough of padder back at least in this article.

Oscillator problems occur frequently in battery sets, la because the need for ba economy reduces the margi valve performance and also operating conditions. Howeve recall an incident, which I squeeze in just here, to illu just the reverse.

AUTODYNE SET

The set was an old time a- having a 24A as an autodyne quency changer. The complain that the set was reliable and it was likely to cut out altog during wet weather. This familiar fault. The old time lator coils tend to absorb mo sufficient, apparently, to r their "Q" factor and prever valve from oscillating.

The first step in this case w remove the coil from the cha fortunately not a difficult heat it well by holding the down the centre of the former immersing it in hot wax.

I keep a pot of paraffin handy for just such occasion wonderful what a smooth c thin wax will do for an oth unsightly and infirm componer wonderful, too, what my wife

(Continued on Page 99)

Here's your answer, Tom!

For Tom, this month, it's back again to simple sets and the familiar problems which have worried beginners since many of us were in short pants. Most of the questions have to do with two and three valve regenerative sets, with Reinartz coils, audio transformers and all the rest.

OW typical is the first question. It is so elementary to the experi-)ed constructor, yet who hasn't ed it at some time or other?

Does it matter what kind of wire use when wiring up a receiver? notice that a lot of old sets used re wire, while the newer ones variably have insulated wire.

hough you mightn't think so, Tom, ion has a lot to do with radio set truction.

ack in the old days, when sets e built on wooden baseboards, idea was to make them impres- and technical looking. The panel an array of mysteriously num- d dials, and the owner took a

nt in the card which showed umbers for all stations within . Tuning a set was rather like ng a combination safe. ing up the lid, revealed an of bits, connected together with r busbar, and forming a scrupu- pattern of straight lines and angles. In this fashion, the went up and down, round and , so they didn't short one to the Those were certainly the days, We fretted if an angle wasn't o so.

'n came the era of the steel s, the elimination of lift-up lids, h apparent effort to convert the side into a rat's nest of wiring guarantee of the set's complex- modernity, mystery and what you. Thank goodness reason returned and everybody now an effort to avoid the "rat's result.

to get back to your question, you can wire up a set with any recognised insulated hook-up wire. Most of it, these days, is plastic covered, and it is quite okay provided that you do not leave the iron in contact with the wire long enough to melt the plastic and leave room for short circuits.

Avoid twisting leads tightly or running them round sharp objects likely to puncture the insulation. The B-plus lead is the one to watch in particular. Pre-war rubber-cum-cotton wire gave little trouble in this respect, but there is very little of this wire nowadays in circulation.

Bare copper busbar can be used for earth wiring, but not for other circuits unless it is at least covered with spaghetti. Even if astute bending prevents direct shorts between leads, a chassis wired with bare copper would be a brute to test. Just imagine poking a metal-tipped test prod down through a group of bare wires!

And by the way, Tom, don't do as one enthusiast did and wire a set with cotton-covered wire of the type used for coils. The insulation is easily pushed out of place and the wire is generally too fine to stand up on its own like busbar.

What kind of flux do you recommend, and would it be better to avoid using it altogether?

This question reminds us, Tom, that the same chap who wired his set with the cotton-covered stuff just mentioned, also used "spirits of salts" as it is commonly called for the soldering operation. Maybe he was a plumber in everyday life.

Spirits of salts—or sulphuric acid is just the stuff to eat away the zinc coating on guttering and downpipe, but it is equally potent on the bits in a radio set. When we saw the underside of this genius' effort, the chassis was a mass of rust, the sockets were whited and blistered by the fumes, and a lot of other things looked the worse for the tragic treatment. No, Tom, the spirits and feather technique is all right for roofs, but just the reverse for radio sets.

Soldering pastes for radio work are chemically different and intended to operate on copper, nickel, tin and silverplate. They may be mildly corrosive, but do not cause any trouble in ordinary radio sets provided they are used sparingly—just a smear on the surface to be soldered. If any flux remains after the joint is complete, wipe it away with a piece of rag.

The real trouble comes when constructors use great "dollops" of the stuff, so that it runs down into sockets and mounting holes, producing possible loss or breakdown paths.

Some zealots go so far as to ban the use of flux altogether, relying on resin-cored solder to effect a good joint. Maybe it works in radio factories, where all the bits are shiny and new, but the technique isn't very successful under other conditions. If wires and terminals are slightly dirty or corroded, it is quite a job to make solder stick properly without a spot of flux to help things along.

After all, dry joints in a radio set are more serious than the possible effects of flux, properly applied.

What is meant by the term "grid leak?" It is used quite a lot in some of the old radio books which I have on hand.

Well, Tom, "grid leak" was one of those terms which came into being when radio was a new science, when the pioneers were searching around for names to call things.

We know now that any valve requires a d-c return path for the grid

GRID
LEAK
OHM

back to the cathode or filament. This applies, irrespective of whether the valve is used as a detector, an audio, or an RF amplifier. If a resistor is involved it can correctly be called the grid return resistor, or some such name.

In the days of the pioneers, however, attention was centred around detectors and the return resistor was visualised as providing a relief or return path for the signal pulses fed to it through the coupling condenser. This was quite correct, of course, and it gave rise to the term "grid leak."

The expression is still used quite commonly in connection with detectors, but the component is fundamentally just a grid return resistor, as necessary with any valve having a resistance-capacitance input circuit. Its functions can be likened to the grid resistor of an oscillator or audio amplifier, or even the load of a diode detector.

In terms of value, a "grid leak" or detector grid resistor may be anything from about 0.25 meg. to 5.0 megohms. A good deal depends on the type of detector valve and its operating conditions. Generally, small low-gain battery valves work best with the larger values, while more modern high-gain or a-c types require lower values for best results. It's largely a matter for trial and error.

Has resistance coupling as much gain as transformer coupling in a 2-3 valve regenerative set?

We seem to have answered this question before, Tom, but never mind, here we go again.

The answer really depends on the type of valves used — in particular whether triodes or pentodes.

By way of example, a typical triode might give a stage gain of 10 times under average conditions, meaning that the output signal is 10 times greater than the signal originally applied to the grid.

If fed into an audio transformer, the output may be stepped up 3, 4 or even 5 times, according to the transformer ratio, so that the overall gain of the valve and transformer may amount to 30, 40 or 50 times, as the case may be. This "free" gain, afforded by audio transformers, made them very useful when valves were less efficient than they are today.

Unfortunately, transformers can't very well be good and cheap at the same time, and many of the older transformers gave the step-up all right, but eliminated a good deal of the bass and treble in the process. We mention the point, Tom, although it was much less important than gain in years gone by.

With the advent of pentode valves, it became possible to get a gain figure of at least 50 times from a resistance-coupled stage, with better fidelity and more cheaply into the bargain. For this and other reasons, audio transformers ceased to be a standard item in every set.

An obvious thought follows that transformers could be used with pentodes to give really enormous gain — perhaps four hundred or five hundred times, in certain cases. However, there is a very serious "nigger in the wood-pile." The difficulty is that pentodes have a very high plate resistance and are fundamentally unsuited for operating into an audio transformer of the usual type. The frequency response of the combination is just terrible and the overall gain at most frequencies is lower than with resistance-coupling. The bright idea, therefore, collapses in the dust.

Coming back to your question, then, the answer resolves itself into a double-barrelled affair. When following a triode, transformer coupling definitely gives the higher gain, the difference being roughly equal to the primary to secondary turns ratio of the transfomer. Following a pentode valve, resistance-coupling only can be used, but, with proper circuit conditions, the overall gain should be at least equal to that of a comparable triode and transformer combination.

We haven't said a word about operating voltages, bias and so forth, but that is really part of a much longer story.

Is it right that you must use an audio transformer in a set intended for the short waves?

No, Tom, somebody has been pulling your leg "good and proper." We've described dozens of shortwave sets in past issues of Radio and Hobbies and few if any of them contain an audio transformer. Still, we must agree that they were nearly all superhets, and there may be a half-truth behind the statement you refer to, when thinking of small regenerative sets.

Old-style triode detectors don't always oscillate readily on the short waves and it may be important to get plenty of volts on the plate — perhaps more than would be available with a resistance in the plate circuit. In this case, a transformer might help.

Then, of course, it would be essential to have as much gain as possible, and, once again, the transformer would have an advantage after a triode detector. Adding together these two practical observations, it might be easier to get an old set going on the short waves if it had a transformer after the detector.

But you will appreciate that the technique and the reasoning behind all this belongs to a past decade and has no bearing on what can be done with a more modern approach. No, Tom, you don't have to use a transformer in a set for short waves any more than you have to use priming cocks in the cylinders of a car. They were darned handy devices in father's day, but that's a long time ago!

Can you use an IF transformer in place of an audio transformer? I see that they have the same markings.

The answer is definitely "No," despite the similarity of the markings. The point of the matter is that the windings of an audio transformer have thousands of turns of fine wire wound over a large iron core and giving an inductance of several henries. At audio frequencies, this constitutes a useful load for the preceding amplifier valve.

An IF transformer, on the other hand, has much smaller windings which are deliberately tuned with condensers to resonate at a certain frequency — say 455 kc. This resonant frequency is the only one which an IF transformer will handle properly. At audio frequencies, the load presented by such a device in the plate circuit of a valve would only be a few ohms and the valve just could not amplify under these conditions.

The same remarks would apply, by the way, to certain "radio frequency transformers," which we have seen in the hands of old-time set builders. They just won't work at audio frequencies.

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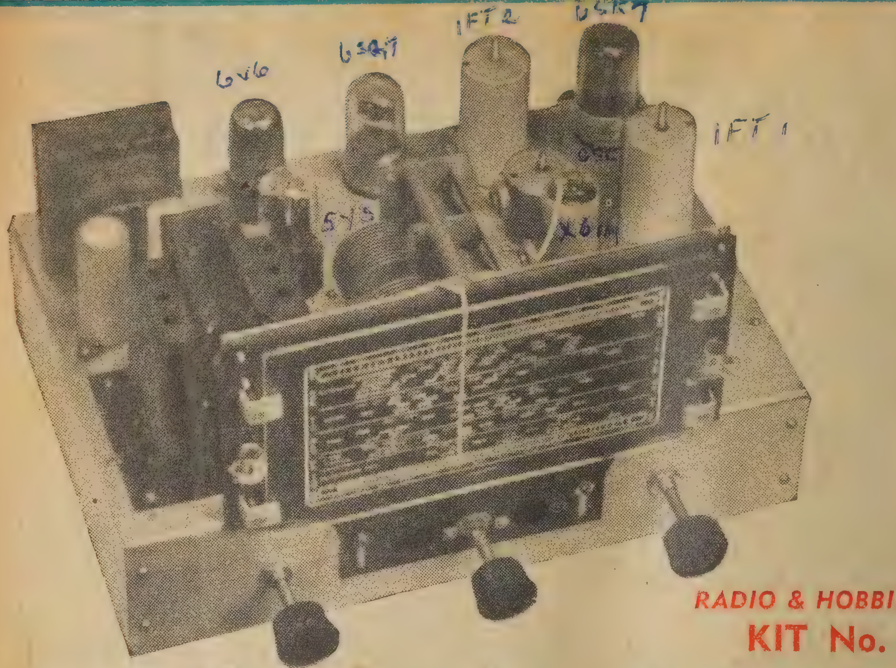


RADIO & HOBBIES
KIT No. 1

SIMPLIFIED B/C SUPERHET

ybe you've never tackled the construction of anything larger than a baby set. Perhaps u've been away from radio for some years and are out of touch with the set building game. hichever way it goes, you'll have no difficulty in building up this simple but effective re- iver and—what's more—making it really perform. By the time this article appears in print, number of firms should be offering the kit for sale, complete "to the last nut and bolt."

RY month we produce a new batch of designs which keep radio experimenters on their n—big sets, amplifiers, test instru- tis and so on. At the other end the scale are the articles for nners and the circuits for one two valve sets.

t what of the in-between reader e one who wants to build a larger ver, but lacks the confidence to e the job? This one has been ned especially to plug that gap. a real set in every sense of the l, but so simplified and so pre- d that no who can follow a dia- h and use a soldering iron should rong.

the Editor points out elsewhere, intended to be the first of a le series of simplified designs h will include other AC sets, ery sets, amplifiers and perhaps a few rudimentary test instru- ts. How far we ultimately go, ends on how readers and the e respond to the scheme.

for this present set, it is electrically similar to the five valve receivers you'll buy anywhere round the radio and furniture stores. It has plenty of reserve gain and will play the stations easily even if, at the outset, it is not adjusted right "on the knocker." You can build it into a kitchen cupboard or invest in a console cabinet as you please.

There are even pick-up terminals available in case you have any ideas about a radiogram combination.

That, briefly, is the story behind the first of this new series — the "Simplified A-C Superhet" or Radio and Hobbies "Kit No. 1."

For the rest, we are not going to talk about the circuit, interesting though it may be. The burden of the article is simply to tell you how to build it.

by Raymond Howe

Before you can really get down to business in constructing this set, there are certain tools which will be needed, some essential, some handy.

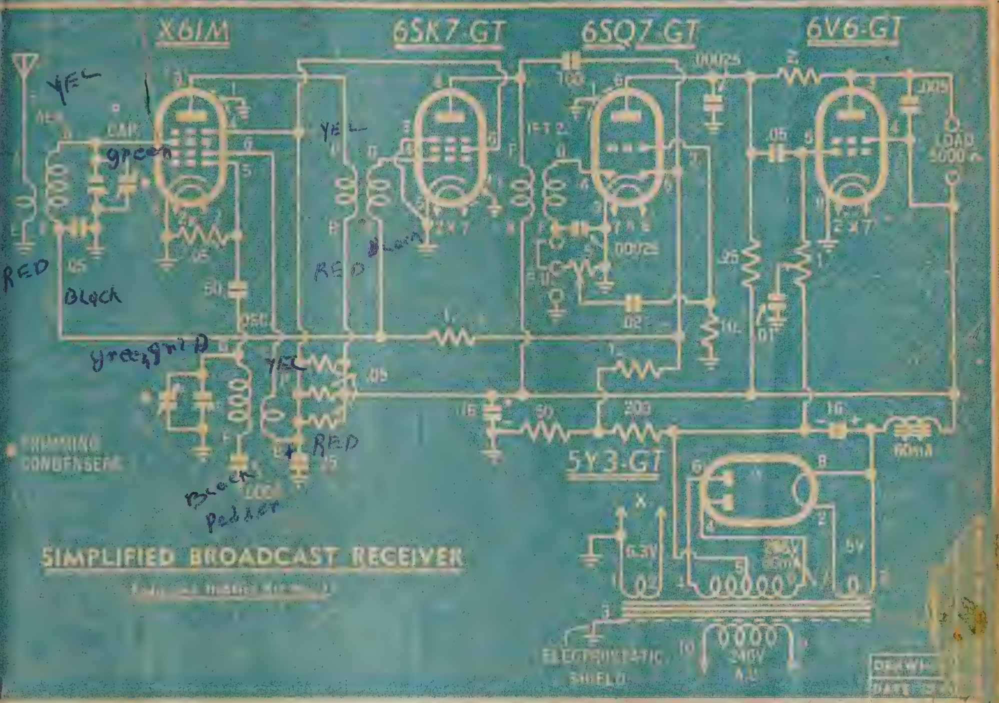
The essential tools include a medium-sized screwdriver suitable for 1/8th or 5BA screws, a pair of side-cutting long-nosed pliers, a sharp knife, a medium-sized soldering iron, preferably electric. Lastly, small amount of soldering paste is necessary and a piece of cloth for cleaning the iron bit.

The "handy" tools include a spintite or box spanner for 1/8th or 5BA nuts, a pair of angle or side-cutting pliers and an aligning tool. You can please yourself about the box spanner but the angle-cutting pliers are really handy. They are better for cutting hook-up wire and for stripping insulation than the long-nosed pliers although, of course, the job can be done without them.

Let's assume now that you have

CONVERTER | I.F AMP | Det AMP | BEAM POWER

CIRCUIT IS STRAIGHTFORWARD AND RELIABLE



Here is the conventional schematic circuit diagram. There are no tricks and no superfluous parts but you can be sure of good erformance. The circuit follows along similar lines to commercial 5-valve consoles on sale in Australia. Some coil manufacturers ecify a 425 pf. "padder" condenser in place of the .0004 mfd (400 pf) unit specified. This may be substituted, if desired.

n the kitchen table or workshop ench all the components necessary construct the set, including those ems mentioned in the "sundries" ection of the parts list.

Unwrap the chassis and ascertain hich is the front and back. Relate he holes to the layout of the major omponents, as illustrated in the ayout photographs and wiring diaram and get a mental picture of hat goes where.

Sort out the five octal valve ockets and the 4-pin socket from he pile of bits and pieces and ount them on the chassis in the ame way as shown in the under-hassis wiring diagram.

OCKET KEYWAY

With the moulded type of socket, hich we used in the set, the posion of the keyway in the centre ole of the socket is generally at ight angles to the line running hrough the two mounting holes.

With the wafer type sockets, the eyway is more usually in line with he mounting holes. Whichever ocket type you use, mount it as llustrated in the wiring diagram. The ready-made chassis is punched o suit.

The next step is to fit the power ransformer. Identify the leads rom the transformer from its accompanying color code chart or from our wiring diagram, fit the mounting plate supplied with the transformer and locate on the chassis as indicated in the wiring diagram.

In the case of the upright type of transformer without a terminal board, secure a 5-tag mounting strip near the corner of the chassis under one of the holding-down bolts. This strip carries the leads to the tapped primary winding, that is, the one connecting to the a-c power mains.

With a horizontal mounting type of power transformer, position it in the cut-out such that the lugs for the 240 volt primary winding on the terminal board are toward the end of the chassis. Actually, it is not very important which way the transformer mounts into the cut-out, although the position mentioned above permits a neat arrangement of the wiring and keeps the connections to the a-c mains to one side of the chassis.

PART LIST FOR KIT No. 1

1 chassis 13" x 9" x 3".
1 power transformer 285V per side at 60mA, 6.3V 2A, 5V 2A.
1 60 mA filter choke.
1 2-section gang tuning condenser (AWA or Stromberg H).
1 dial to suit (USL32 or similar).
1 broadcast aerial coil, 1 broadcast oscillator coil.
2 standard 455 kc. intermediate transformers, Nos. 1 and 2.
2 gang trimming condensers.
5 octal sockets, 1 4-pin socket.

VALVES
1 X61M, 1 6SK7-GT, 1 6SQ7-GT, 1 6V6-GT, 1 5Y3-GT.

CONDENSERS
2 16 mfd. 525PV electrolytics, 1 0.25 mfd. 400V, 1 0.05 mfd. 400V, 1 0.05 mfd. 200V, 1 0.02 mfd. 1 0.01 mfd. 1 0.005 mfd. 1 0.0004 mfd. mica, 2 0.000025 mfd. mica, 1 100 pf., 1 50 pf.

RESISTORS
1 10meg., 1 2 meg., 2 1 meg., 1 meg. potentiometer, 1 0.5 meg. potentiometer, 1 0.25 meg., 1 watt, 3 0.05 meg. 1 watt, 1 0.05 meg., ½ watt, 1 200 ohm 3 watt wirewound, 1 50 ohm 1 watt.

SUNDRIES
5 terminals (2 red, 2 black, 1 other color), 3 knobs, 1 grid clip, 1 5-tag mounting strip, 1 3-tag mounting strip, 3½in of terminal strip, power flex and plug, 1 4-pin plug for speaker, approx. 15in of shielded hook-up wire, nuts and bolts, hook-up wire, solder, solder lugs, etc.

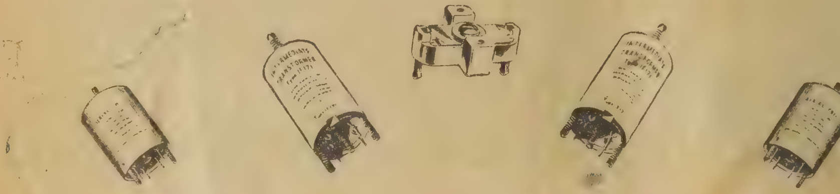
Build your own Superhet

with COIL KIT No. K126

for the 5 Valve A.C. Broadcast Receiver

Detailed in this issue.

R.C.S. again offer you service and convenience with a new special coil kit. This kit, No. K.126, has been specially designed and tested to give peak performance and to facilitate the construction of the 5 valve A.C. Broadcast Receiver circuit in the hands of the amateur. However the contents of the kit are not exclusive to the set and will be of value in any "ham" workshop.



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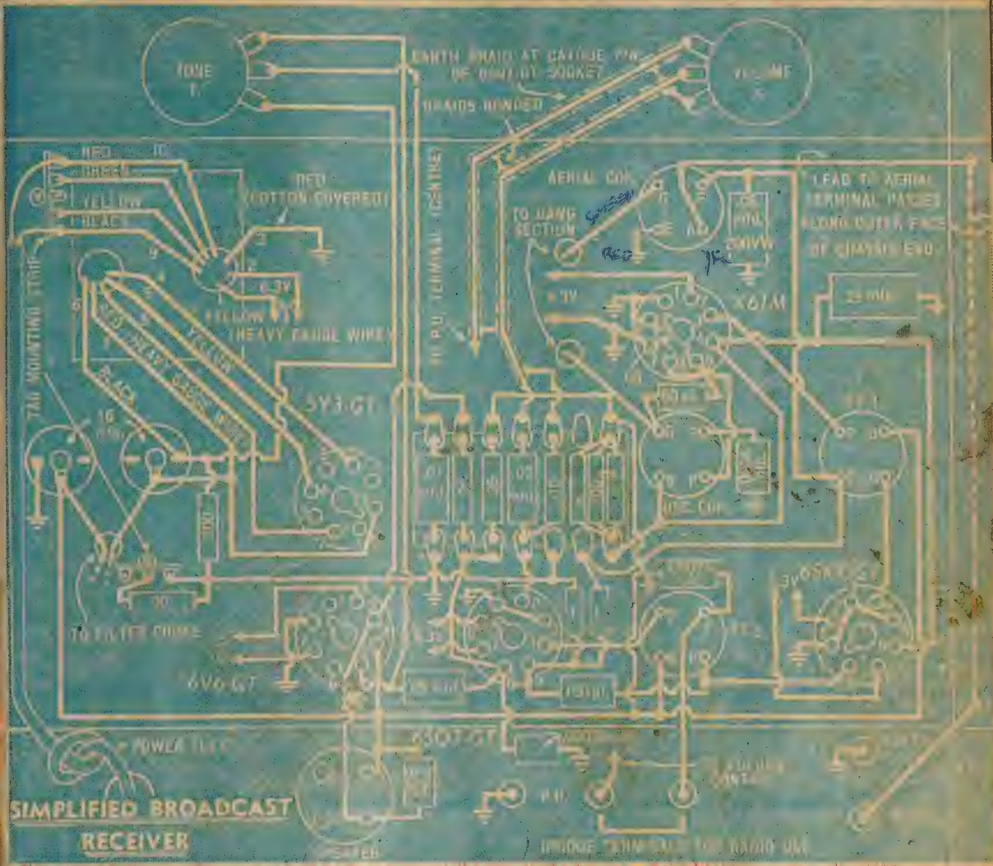
A HANDY GUIDE TO THE UNDER-CHASSIS WIRING


TONE
VOLUME
EARTH BRAID AT CATHODE PIN OF 6Q7-GT SOCKET
BRAIDS BONDED
RED
GREEN
YELLOW
BLACK
RED (COTTON COVERED)
6.3V
YELLOW (HEAVY GAUGE WIRE)
TAG MOUNTING STRIP
5Y3-GT
16 MFD
TO P.U. TERMINAL (CENTRE)
AERIAL COIL
Green
TO GANG SECTION
RED
Yel
LEAD TO AERIAL TERMINAL PASSES ALONG OUTER FACE OF CHASSIS END
X61M
6.3V
OSC. COIL
6V6-GT
TO FILTER CHOKE
6SQ7-GT
POWER FLEX
P.U.
SPEAKER
BRIDGE TERMINALS FOR RADIO USE
SIMPLIFIED BROADCAST RECEIVER

This pictorial diagram shows every lead in the set except the one to the top cap of the X61M converter valve. With one or two exceptions all the small parts are in the same positions as in the original chassis.

For those who are making their first ambitious attempt at radio construction we are including diagrams of the terminal boards for two popular brands of horizontal-mounting transformers. We have numbered the lugs to correspond with the numbered leads in the circuit diagram and the underchassis wiring diagram. The numbering idea is to avoid the possibility of confusing the leads with transformers of differing design.

Now mount the two 16mfd electrolytic filter capacitors. Note that the can of at least one of these, the inside one, in the wiring diagram must be insulated from the chassis. We suggest that you use the type which is provided with a small oval-shaped bakelite mounting board.

The filter choke is next on the list. As in the case of the power transformer, one of the holding-down bolts is used to secure another tag mounting strip to the chassis. A 3-tag size will do. It is used to mount the two resistors in the back-bias network.

With all this "ironmongery" in place, the chassis will very nearly stand on end thus making it easier to mount the coils and IF transformers.

As in the case of the valve sockets, the coils and IF transformers should be located with the connections in the positions illustrated in the wiring diagram. The aerial coil and the oscillator coil can be identified by markings on the can.

The IF transformer for No. 1 and No. 2 positions respectively can be identified either by direct marking as such or by the sequence of the type numbers.

The transformer for No. 1 position will have a lead protruding from the top of the can. However, as the IF amplifier valve used in this set has the grid connection brought out through a pin in the base of the valve, this lead is not required.

Actually, this lead goes down the inside of the transformer can to the pin marked "G", one of the four terminals which protrude from the bottom of the transformer. In a case like this where this lead is not required, it should be cut off either from inside the can or just close to the top of the can making sure that the bare end does not short to the can. Leave about 1/8th of an inch protruding for safety.

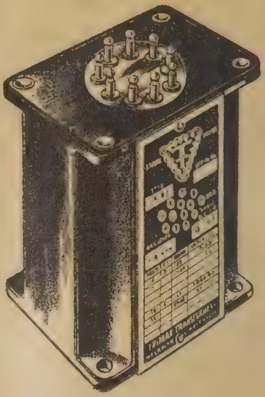
The remaining chassis-mounting components, namely volume and tone controls, the tuning gang condenser, terminals and terminal board, can now be put into place. Do not forget to use an insulating washer with those terminals which should not be earthed to the chassis. An ordinary 1/8th inch metal washer can be used under the two earth terminals.

RESISTOR COLOR CODE

VALUE	BODY	END	DOT
10 megohm	Green	Black	Green
2 megohm	Red	Black	Green
1 megohm	Brown	Black	Green
0.25 megohm	Red	Green	Yellow
0.05 megohm	Green	Black	Orange
50 ohm	Green	Black	Black

TRIMAX

TRANSFORMERS



Trimax are proud to introduce their new N. S. W. distributors, and give details of their standard designs in High Fidelity and Low Level Type transformers.

TYPE	CASE	APPLICATION	IMPEDANCE-OHMS (See Notes 1, 2, 3, 4.) Primary	Secondary	TURNS RATIO	MAXIMUM LEVEL dbm. (See Note 5)	FREQUENCY VARIATION db/cycles
MIXING (LINE TO LINE) TRANSFORMERS							
TA636	M8-M66	Line, Microphone or Pick-up Matching Balanced or Unbalanced.	50	200	1-2	+18	± 0.5/30—40,000
TA406A	" "		50	600	1-3.46	"	" "
TA101	" "		200	200	1-1	"	" "
TA168A	" "		200	600	1-1.73	"	" "
TA37A	" "		600	600	1-1	"	" "
TA793	M17	See Note 7.	600	600	1-1	+36	± 0.5/30—15,000
INPUT (LINE TO GRID) TRANSFORMERS—MULTI SHIELDED							
MS860	M66	Line, Microphone or Pick-up to Single or Push-Pull Grids.	50	100,000	1-447	+10	± 1.0/30—10,000
MS837	"		200	100,000	1-22.4	"	" "
MS878	"		600	100,000	1-12.9	"	" "
OUTPUT (PLATE TO LINE) TRANSFORMERS							
TA835	M8-M66	Single 7,000-10,000 ohm Plate to Line.	20,000	50	20-1	+24	± 1.0/30—12,000
TA833	" "		20,000	200	10-1	"	" "
TA733B	" "		20,000	600	5.8-1	"	" "
TA947	" "	Push - Pull 7,000-10,000 ohm Plate to Line.	30,000	50	24.5-1	+27	" "
TA948	" "		30,000	200	12.3-1	"	" "
TA710A	" "		30,000	600	7.1-1	"	" "
MIXING (LINE TO LINE) TRANSFORMERS—MULTI SHIELDED							
MS944	M66	Line, Microphone or Pick-up Matching Balanced or Unbalanced.	50	200	1.2	+10	± 0.5/30—40,000
MS866	"		50	600	1-3.46	"	" "
MS945	"		200	200	1-1	"	" "
MS946	"		200	600	1-1.73	"	" "
MS896	"		600	600	1-1	"	" "

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You are now in a position where a hot soldering iron is the next requirement. Without going into any great dissertation on "How to use a soldering iron in ten easy lessons" we would like to emphasise the point that a clean well-tinned bit is an essential to good soldering.

In making a connection, use resin-cored solder and impart sufficient heat to the joint such that when the solder is touched onto the iron tip and the joint, the molten solder runs freely. A very slight smear of soldering paste will be found helpful but be very sparing with it.

In commencing the wiring, start with the power transformer. Where no terminal board is provided identify the leads by the coloring of the outside insulation.

WIRING SEQUENCE

Commencing with, say, the red-covered pair of heavy gauge wire, twist them together, lay them into position at the rectifier socket and trim them to length. With the aid of the knife or the cutting pliers remove the insulating sleeving for about 3/8th of an inch, being very careful not to cut the wire. Use the knife to scrape the enamel insulation from the wire itself. Remove all of the enamel otherwise it will be difficult to make a good soldered joint. "Tin" the wires with flux and solder before you attempt to attach them to the socket.

Follow the same procedure with the heavy-gauge yellow-colored pair and the light gauge yellow-colored pair. The four leads from the 240 volt primary winding, constituting the common lead and the primary taps, are taken to the four insulated tags of the 5-tag mounting strip. Remember that the centre tag of the single-hole-mounting tag strip is actually earthed to the chassis and must not be used as an anchor point on this particular strip.

With the flat-mounting power transformer, with terminal board attached, the connections from the board to the rest of the set are made with ordinary hook-up wire, twisting the leads together as mentioned above.

Complete the wiring of the back-bias resistors, filter choke and the electrolytics. Some constructors like to color the leads on the diagram as they are installed to avoid overlooking any.

HEATER WIRING

Run the 6.3 volt leads from the transformer to pins 2 and 7 of the 6V6-GT socket. From these pins run twisted leads to the heater pins of the sockets of the other three valves. Keep these twisted leads tucked close to the bends of the chassis as far as possible.

The next step is to put in all of those leads which run direct from valve socket to valve socket or from valve socket to coil or IF transformer.

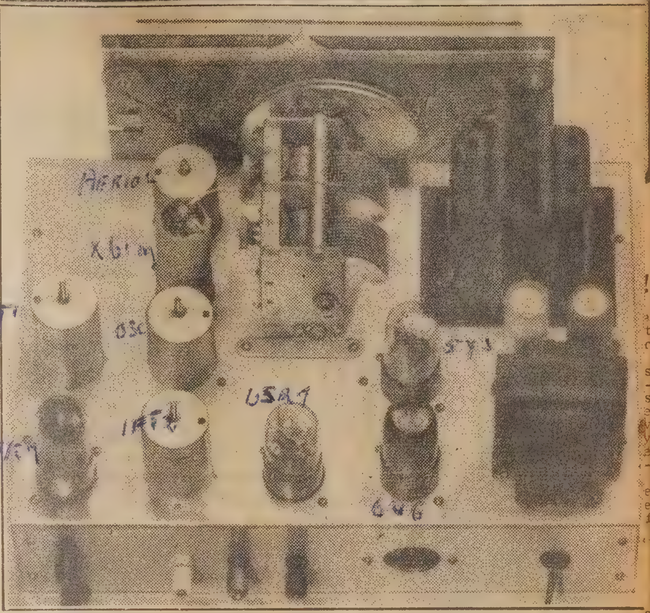
Now is the time to put in the components not mounted on the terminal board in the centre of the chassis. Start with the five components grouped near to and around the X61M socket. Follow this with the components grouped around the sockets of the 6SQ7-GT and the 6V6-GT.

You will notice that the pig-tail connection to the "outside" foil of tubular capacitors is marked on the label or, where there is no label, with a small moulded "blob" near the value marking. Where one end of the capacitor connects to earth, the pig-tail marked as the "outside foil" should be the one connecting earth.

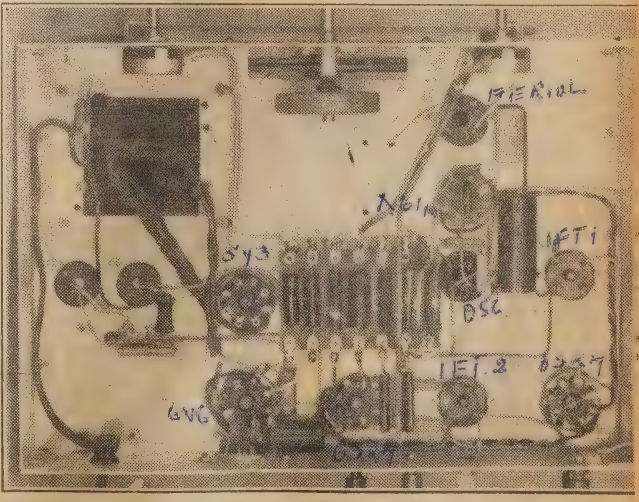
Speaking of the reference "eart it is usual to consider the chas itself as being "earth" in so far the wiring of the set is concerne it being the point of zero reference potential.

Sort out the capacitors and res tors which have a place on the te

REAR AND UNDERNEATH VIEWS



With a ready-punched chassis, the job of assembly is a very simple one. Main point to watch is that the sockets and other components have their pins facing in the directions indicated by our wiring diagram.



This under-chassis photograph is necessarily too small to show many details but it does indicate the general appearance of the finished wiring job. Try to make your own chassis just as tidy and systematic.

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minal board and mount them in the positions shown in the wiring diagram. Connect the leads to this board according to the diagram and wire in the two 1 megohm resistors.

In laying in the shielded wiring from the volume control, keep it reasonably taut so that it supports itself across the chassis. Earth the shielding braid where it passes over the 6SQ7-GT socket by a short wire direct to the cathode or common earth point of that socket.

All that remains now is to connect a grid lead from the gang condenser to the grid of the X6IM and mount a trimming capacitor across each section of the gang. It is important that the upper plate of each trimming capacitor connects to the frame of the gang.

In fitting the tuning dial, remove the screw which holds the drive drum to the dial back plate and mate the drum with the drive spindle of the tuning gang. Be careful not to let the drum slip out of your hand during this operation because if you are not familiar with the way in which the cord drive threads around the drum, it can be rather annoying trying to work it out.

WHAT ELSE?

THE chances are that we have overlooked something which is a real problem to the very readers we are trying to help. Take a good look at the article and the diagrams, pick out the things that might still trick you and let us know about them. Thus guided, we can "tailor" the forthcoming articles to fit your needs more closely.

Tighten the drive drum onto the gang spindle such that there is equal overlap at either end of the pointer on the dial scale.

And now for the "big moment." Plug the valves into their correct sockets, leaving the 5Y3-GT rectifier out for the moment. Make sure that there is a bridge across the two appropriate terminals at the rear of the chassis. Connect the speaker to the speaker socket and we're ready to go.

INITIAL TEST

Forget about the beads of perspiration on the forehead and just plug the power flex into the power point. See that the four valves light up OK. Now gently plug the 5Y3-GT rectifier into its socket and watch for any blue glow inside this valve. Any such glow indicates a short circuit or heavy load on the rectifier and the set should be switched off immediately and the fault located.

Assuming that all is well so far and that it is possible to produce a loud squeal by placing one finger on the bridge across the terminals and turning up the volume, you are ready to check the alignment of the tuned circuits. Don't forget that it is important that the dial glass should suit the gang condenser, whether it be of AWA or Stromberg H design.

If you have a service oscillator

on hand, it is assumed that you know how to use it. Nevertheless, in case you are interested, there is available through the R and H 1/- Query Service a pamphlet which gives detailed informatioin on how to align a superhet radio receiver.

When using a service oscillator, the IF transformers would be aligned to 455kc as the first step. However, assuming that you have no such device, connect an aerial to this set and see if you can tune in any stations. If a number of stations come to light, identify one near the low frequency end of the dial. In Sydney, 2FC is a handy marker.

If the selected station does not appear at its correct place on the dial, adjust the slug in the oscillator coil until it does. While still tuned to the same station, adjust the slug in the aerial coil for maximum volume.

If the signal is too strong to get a very precise peak, the adjustment can be carried out roughly at first, then rechecked in the evening on an adjacent but weaker interstate station.

Now swing the dial down towards the other end and select a station there, Again, in Sydney, 2SM is a suitable marker. Peak the trimmer mounted across the aerial circuit section of the tuning gang for greatest volume. If the station does not correspond with the dial markings, adjust the trimmer across the oscillator tuning section of the gang until it does. For each adjustment of the oscillator trimmer, readjust the aerial trimmer for greatest volume.

SECOND CHECK

Tune the set to the selected station at the low frequency end again and recheck for alignment with the dial marking. If any slight readjustment is found necessary, swing back to the high frequency end and recheck the trimmer settings. The "golden rule," remember, is to adjust the coil slugs only at the low frequency end and the trimmers only at the high frequency end of the band.

Now tune to any station and adjust the slugs [illegible] the IF transformers for greatest volume, starting with IFT2. Go through the IF transformer adjustment procedure twice to counteract any interaction between adjustments.

Just to wind up the article a few general remarks may be helpful. First off the speaker. You will need a permagnetic type, or a permanent magnet dynamic type, to give it the full name. Size has quite a lot to do with the general standard of reproduction.

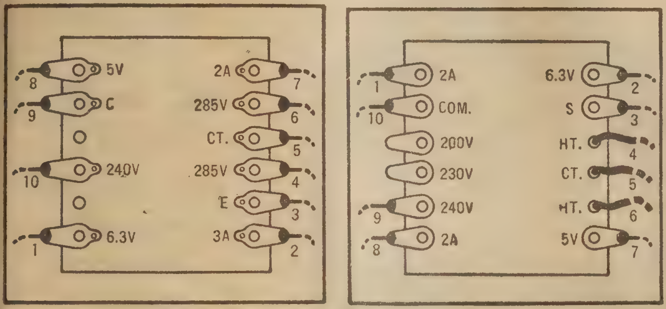
A 3in speaker is hopeless, and a 5in type is inadequate. A 6in type is still on the small side, but either a 7in or an 8in speaker could give good results. A 12in speaker is really the best choice, provided there is room in the cabinet to accommodate it. Whatever you choose, however, avoid old speakers, or relics of past days. The difference between a modern permag. and an old fashioned one is at least two to one, both in respect to output and tone.

The speaker will normally come fitted with an output transformer, which should be matched to a 6V6 type output valve. Put another way, this means a load impedance of 5000 ohms. There should be two leads only coming from the speaker transformer and these connect via a plug to two pins on the speaker socket, as shown on the wiring diagram. One goes to the 6V6 plate and the other to the B-plus line.

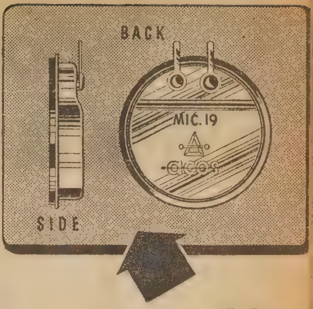
If the speaker happens to be provided with a third wire connecting to the frame, this can be connected via the speaker plug to the chassis of the set, thus effectively earthing the speaker frame. No special importance attaches normally to such a connection, but there are occasions when it might clean up the last trace of oscillation in a "touchy" set.

Speaking of oscillation, the set may tend to approach instability when tuned to the low frequency end of the band, and with no aerial attached. This has to do with a resonance effect in the primary of the aerial coil, and it is more noticeable with some coils than with others. The set should be entirely stable, however, with a reasonable length of aerial connected to the terminal.

Well, there you are. You have now reached the end of the task which you must agree was not a very difficult one. You can now rightfully boast to yourself — and others if you like—that you have built a set which can really perform. All this and pickup too, if you want it.



You may wish to use an alternative type of power transformer with a terminal board attached. The layout of two popular types is illustrated above, with their normal markings and the leads numbered to correspond with the wiring diagram on page 55.



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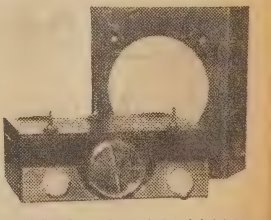

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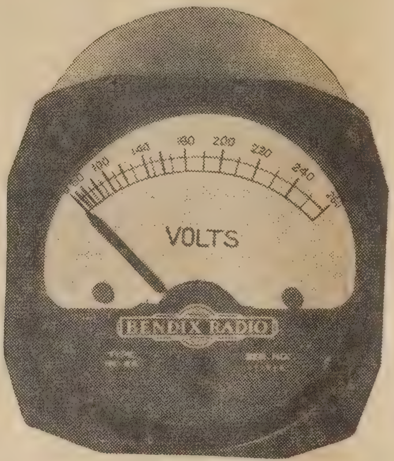

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PUTTING YOUR C.R.O. TO WORK

By W. N. WILLIAMS

The CRO is the first instrument an engineer turns to when checking the operation of an amplifier. While it cannot show extremely low amounts of distortion, it does indicate very clearly the effects of improper operating conditions, faulty components and so on. This article explains in detail the set-up required for observing waveform and linearity.

IN testing an amplifier, there are fundamentally two methods of approach, both of which are commonly used. One is to inspect the output waveform directly, the other to "plot" output against input and observe the character of the resultant trace. Figure 1 illustrates the typical bench set-up necessary for these tests.

The chassis of the amplifier is bonded to the earthed output terminal of the audio generator and likewise to the earthed vertical input terminal on the C.R.O.

CONNECTIONS

The "live" terminal from the audio generator is connected to the input of the amplifier, while the amplifier output is fed to the vertical input terminal on the C.R.O. If only portion of the amplifier is to be tested, then the input and output leads are connected, as required, to the actual circuits under test.

This is sufficient for waveform inspection but, for a linearity test, a further connection is made between the audio generator and the horizontal input terminal on the C.R.O., as indicated in figure 1.

It may be appropriate at this stage to mention the use or otherwise of shielded wire and test leads.

Most laboratory type audio generators have an output impedance amounting, at the most, to a few hundred ohms and it matters little whether the leads to the amplifier and C.R.O. are shielded or not. If they are shielded, the circuit impedance is so low that lead capacitance is not likely to be significant. Alternatively, it is quite possible to use unshielded hook-up wire for both the active and the earth leads, without much danger of hum pickup or instability. A low impedance audio source is therefore a distinct advantage.

HIGH IMPEDANCE

With a high impedance audio generator, it is generally desirable to use a shielded connecting lead to the amplifier under test, both to avoid hum pickup and also the possibility of instability. With a fixed frequency generator, there the matter ends.

If the generator is a variable frequency, high impedance type, the length of shielded connecting lead should be kept to a minimum to avoid capacitive shunting and reduced output at the higher frequencies. This is a fairly obvious point to watch, particularly if an attempt is made to evaluate the frequency response of the amplifier.

The question of capacitance should also be watched in the connecting lead between the amplifier under test and the oscilloscope. Commercial instruments are conventionally supplied with a shielded test lead and prod, which is very handy for snap observations of hum level and waveform at various point in a circuit For more precise work, it should be treated wtih some caution.

The capacitance of several feet of shielded lead is likely to be considerable and, in a not-unusual case, it can exceed 100 pf. per foot. Thus, connection of the test prod to a circuit will make it behave effectively as if it were bypassed to earth with a condenser of around 500 pf.

FALSE RESULTS

Such a value would be of no consequence at all in a low impedance circuit but it could give an entirely false impression of the frequency response of a resistance-coupled audio amplifier.

By way of example, many of the criticisms of the classic phase splitter circuit originate from observations of waveform and output with a C.R.O. lead having a substantial loading effect on the circuit under test. The output impedance of the plate and cathode circuits is different and, while this is of no consequence in normal operation, the circuits react differently to separate and heavy external loading. Thus a false impression is received tha the push-pull outputs are unbalanced.

Quite apart from capacitive efforts the connection of a long lead to a output plate, for example, will occa sionally promote instability, makin further measurement impossible This is not at all unusual in a amplifier or modulator using hig Gm tubes in the output, like the 80 or KT61.

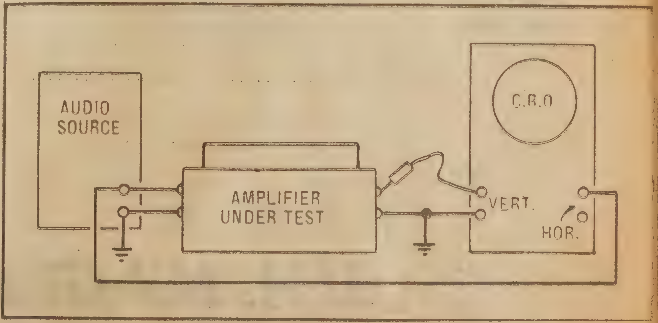
In such a case, it becomes neces sary to reduce the test lead to minimum length—a good thing, any way—and try to locate it so that th feedback is eliminated.

The onset of instability in an am plifier shows up on a C.R.O. scree in various ways. If there is n test pattern on the screen, the oscil lation may transform the norma thin line to a rectangle of hig frequency oscillations varying fro a mere thickening of the line t a pattern that fills the screen. is generally possible to resolve a oscillation pattern into a clear wave form by increasing the sweep fre quency. The oscillation will ofte appear and disappear quite sud denly as the volume or tone contr is operated.

OSCILLATION

With an audio test pattern on th screen, the presence of oscillatio may give an effect similar to figur 2b, or it may be confined to on spot on the cycle, as in figure 2c.

When such a condition arises i an amplifier, make sure that th C.R.O. connection itself is not caus



A typical bench set-up for waveform inspection and linearity checks. Note that some form of audio generator is essential. A simple audio oscillator will do, but a variable frequency oscillator, as described some months ago, is a much better proposition.

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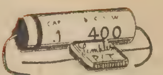

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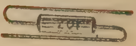

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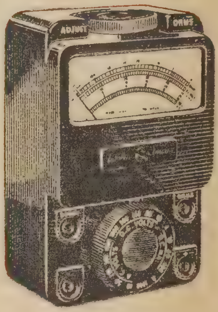

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0-250	0-500	0-500	*5000-200,000-20 megohms
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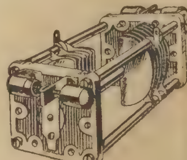

Identical in construction—length only varying according to capacity value—the condensers listed have ceramic end plates 2¼in. square—Single point rotor earthing connection prevents circulating RF currents. Lugs on the stators permit either the direct fixing of the associated coil or for connections to stand-off insulators, etc. Alternative contact points available. Vane spacing 8in.—adequate for high voltages, provided DC is removed by insertion of blocking condenser between rotor and earth. Metal parts, including spacing pillars, supplied for three-point chassis fixing. Standard ¼in. spindle. Each condenser of the split stator type, directly applicable to balanced circuits. For aerial tuning and single-ended circuits, one section may be used singly or both can be connected in parallel. A wide range of working capacities thus becomes available.

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ing the trouble, before taking other corrective measures. In the case of a push-pull amplifier, transferring the test lead to the other plate may give a clear pattern or, alternatively, the C.R.O. gain can be advanced and observations made at the secondary of the output transformer.

If transferring the leads from one point to another consistently shows the oscillation pattern, it is safe to assume that it is a characteristic of the amplifier and corrective measures should be taken. Spurious oscillation in an audio amplifier will limit its power output, give rise to "rattling" and distorted reproduction and, in some cases, cause valves to exceed their dissipation ratings.

These observations may appear to be somewhat off the subject but they are, indeed, very relevant to the business of using an oscilloscope.

WAVE PATTERNS

Referring back to figure 1, the obvious procedure is to observe the waveform as the signal passes through the amplifier from the input terminal to the secondary of the output transformer.

For this purpose, the CRO controls are set for "Internal Synch." and the sweep oscillator is set to a frequency which will produce about three complete waves on the screen. As mentioned last month, the "Synch." control should be advanced just far enough to hold the pattern still and no farther.

The amplitude of the signal will naturally increase as it progresses through the amplifier and this, incidentally offers a ready means of observing the order of gain produced by any given stage.

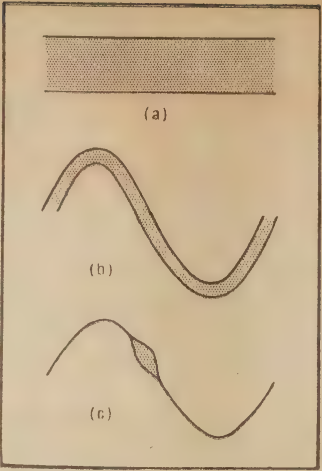
The alternative, or rather the supplementary method of observation makes use of the connection between the audio generator and the horizontal input terminal of the oscilloscope. It is rendered operative in the normal instrument by switching the horizontal amplifier to "External Sweep." In some instruments, like the R & H 5-inch oscilloscope, it involves changing a link between a couple of terminals on the panel.

EXTERNAL SWEEP

Switching to external sweep disconnects the internal sweep oscillator and makes the horizontal spot travel entirely dependent on the audio source. In order to obtain sufficient travel, it may be necessary to turn the horizontal gain well up and/or increase the output from the audio generator, turning the gain back, if necessary, on the amplifier under test.

Under these conditions, the spot is being moved horizontally by the test signal and vertically by the amplifier output. The resultant should be an oblique line across the screen. Just how this comes about is not difficult to appreciate.

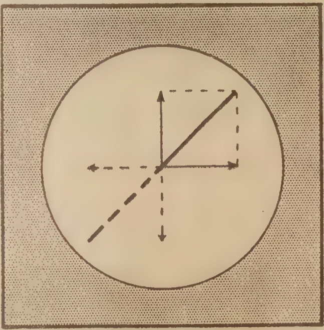
If the spot rests initially at the centre of the screen, the first half cycle of the test signal, operating on the horizontal plates, may tend to move to the right. Simultaneously, the output from the amplifier under test, operating on the vertical plates may tend to move it upwards, giving as a resultant an oblique line.

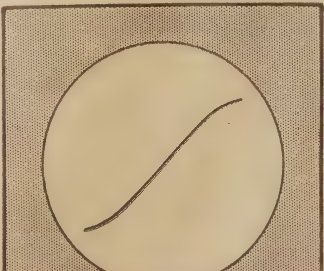


Illustrating the effect of supersonic or R.F. oscillation, as seen on the C.R.O. face.

As the current reverses on the opposite half of the signal, the spot would retrace its path, moving downwards and to the left. Continuous movement of the spot along this path naturally traces a definite line, as indicated in figure 3.

The length of the line and its exact slope naturally depends on the amplitude of the voltages applied t the CRO and the settings of the controls. For convenience, it is usua to set the slope of the line at abou 45 degrees and many instrument have lines scribed at 45 degrees o a reference scale in front of the tub face.


Showing how the linearity trace is produced. Ideally, the trace should be a straight line.


Non-linearity in the amplifier produces a curved trace, the nature of the curvature giving a clue to the effect causing it.

A little thought will show that, i the voltages on both sets of plate remain exactly in step and maintai the same ratio, the oblique lin traced by the spot must be straigh It is, in fact, an instaneous plot c amplifier input against output, jus as obvious as if the quantities wer measured over the cycle and plotte on a sheet of graph paper.

CURVED TRACE

If the amplifier should introduc any large amount of distortion, th voltage on the horizontal CRO plate will not be proportional to that o the vertical plates and the trace wi deviate from a straight line. Th effect can be picked out very readil and note taken whether the curvature occurs at one end or both enc of the trace. It will show degree of distortion occurring in the amplifier which might be missed from a inspection of the output waveform

A handy feature is that the te excludes the effect of small amoun of distortion which may be prese in the test signal from the aud generator. Since it compares in put against output, only the char acteristics of the amplifier unde test can operate to change the line arity of the trace.

One point about the linearity te demands special explanation. To ward the ends of the audio spec trum, where the reactance of con densers and transformer winding becomes important, a certain amour of phase rotation is likely to occu in the amplifier. In other word the output voltage may differ fro the input by other than the exa 180 or 360 degrees.

ELIPTICAL PATTERN

Thus, the spot in moving out fro the middle of the screen may follo a slightly different path from tha which it follows when moving i toward the centre. The result is a elipse instead of a line, the breadt of the elipse depending on the degre of phase rotation.

Where the phase rotation is sma and the elipse remains narrow, th linearity method of test is still suc cessful. It is simply a matter c comparing the symmetry of a nar row elipse with a straight line an any tendency to distortion will b apparent as a bending of the elips

At extremes of the frequenc range, the phase rotation in som cases may be enough to turn th elipse almost into a circle and, whe this occurs, the trace is largely valueless as indicator of distortion. It i necessary then to revert to an ob servation of output waveform whic does not show the effects of phas displacement in relation to the tes signal.

Next month we will attempt t relate these observations to actua operating conditions in amplifie and individual stages.

ANTENNA PATTERN MEASUREMENTS

The characteristics of aerial arrays can be measured effectively by using "models" operating at very high frequencies. The technique is well-known in laboratory practice, but this paper, from the Aerovox Corporation, suggests how the technique can be applied in particular, by amateurs.

MOST of the characteristics of a resonant antenna are, independent of its operating frequency. In other words, an antenna of a given design operating at 3000 Mc., will exhibit the same impedance, gain, radiation pattern, and certain other characteristics as an antenna of like design but 100 times larger in size and operating at 30 Mc.

This fact has led to the important technique of employing scale models in the development of antennas of all types.

MPLE METHOD

By this method, the performance of a large and elaborate experimental antenna array may be predetermined without the labor and expense of construction by first building a scale model which is reduced in size and operating wavelength by a factor of perhaps 1/100th.

The modelling technique is, therefore, a valuable tool in the development of antennas. It is also a very effective method of demonstrating the properties of directional antennas for educational purposes.

The pattern measuring equipment used by the commercial antenna development laboratories for determining the characteristics of model antennas is elaborate and costly. The results obtained, however, may be approximated by the amateur or experimenter with greatly simplified equipment.

The free-space directional characteristics and gain of a transmitting antenna may be determined by plotting the field intensity produced by the antenna as a function of the direction from it.

Although the radiated fields surrounding the antenna are three-dimensional, sufficient information to evaluate the performance of the antenna may be obtained from a two-dimensional plot taken in the plane of greatest importance.

TTERNS

A diagram made in this manner is, in reality, a cross-section of the three-dimensional solid radiation pattern of the antenna. Such plots are called "field patterns" or "radiation patterns," and are usually made on polar-co-ordinate graph paper.

Fig. 1 shows the theoretical power radiation pattern of a half-wave dipole antenna, taken in the plane containing its axis. The half-wave dipole is usually used as the standard antenna with which other antennas are compared. Thus, an antenna with "a gain of 7 db" usually means a gain of 7 db over that of a half-wave dipole.

The heavy line of Fig. 1 is a contour of equal radiated power, with the antenna located at the centre of the diagram. It could be plotted in two ways; by allowing the radiating antenna to remain fixed in position and plotting points of equal power around it, or by rotating the antenna and plotting the variations of a power indicating meter located at a fixed spot some distance away.

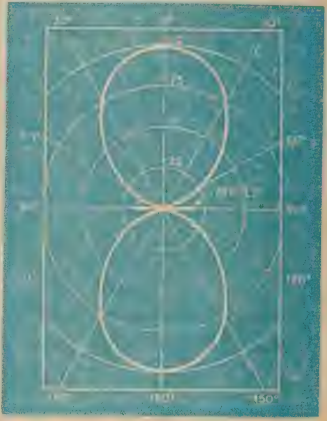


Figure 1. A calculated radiation power pattern for a half-wave dipole. Note that maximum power is radiated at right angles to the element. Proximity to ground and other objects may modify the shape of the pattern in actual practice.

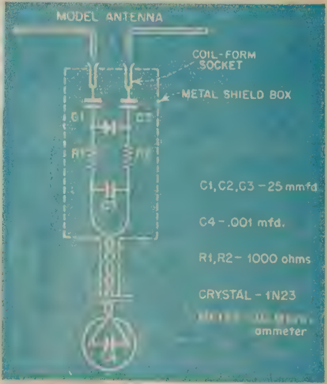


Figure 3. The "receiver" is a simple crystal device using preferably a silicon or germanium diode. A battery diode could probably be substituted. A sensitive meter is desirable, allowing the tests to be conducted with low power and with good separation between the aerials.

For all practical purposes, the pattern and gain of an antenna used for receiving are identical to those of the same antenna when used for transmitting. In the receiving case, the field pattern indicates the relative sensitivity of the antenna to signals arriving from various directions.

Because of this reciprocity in antenna performance, patterns taken on a transmitting antenna also apply to receiving antennas of the same design, and conversely.

Therefore, since the mechanical and electrical requirements are more conveniently satisfied, most pattern measuring systems, including the simplified method to be described here, use a receiving antenna as the model antenna under test.

This receiving antenna is excited (or "illuminated") by a uniform rf field produced by a transmitting antenna operating at the resonant frequency of the test antenna and situated several wavelengths away. A field-strength meter or other rf detecting device is coupled to the receiving antenna to indicate the relative intensity of the signal being received.

The test model antenna is then rotated in the desired plane and the response, as indicated by the rf detector, is plotted as a function of the angular position of the antenna. The result is a radiation pattern of the test antenna.

MODEL ROTATED

In expensive systems, the pattern plotting is accomplished automatically by a recording pen which is actuated radially on the graph paper by the amplified output of the rf indicating device. The polar co-ordinate paper is rotated about its centre of origin by means of a mechanical or electrical linkage which synchronises its rotation with the angular position of the model antenna.

As the system is rotated, the recording pen automatically records the angular response characteristic of the antenna.

The pattern recording equipment which is the subject of this article is "semi-automatic" in nature, since several compromises have been made in the interests of simplicity and economy. It can be assembled at low cost from parts which should be readily available and is capable of producing power radiation patterns of experimental scale model antennas in less than two minutes.

Since the system functions at ultra-high frequencies, the model antennas are quite small and may be fabricated at a cost of only a few pence each.

The essential elements of the system are illustrated in Fig. 2. The model antenna under test is mounted on a "mast" which consists of an 18-inch length of ¼-inch brass tubing. Both mast and antenna are rotated by a "selsyn" motor, which also acts as a base for the mast.

If the frequency used is sufficiently high, almost any of the selsyns which have been abundant in war surplus will provide sufficient torque to rotate the model antennas. Motors of the "5G" size are very adequate.

TEST FREQUENCY

The test antenna is excited by the r.f. field produced by a stationary transmitting antenna placed about 10 wavelengths away, and fed by a stable rf oscillator. The frequency of operation may be any frequency above approximately 400 Mc., depending upon the availability of an oscillator.

The best results are obtained in the 1000-1500 Mc. region, since the model antenna sizes are convenient and reflections from nearby objects are less troublesome. Thus, it is possible to use the system indoors. the rf power required does not exceed one watt if the receiving device has sufficient sensitivity.

The transmitting antenna should be provided with a small cylindrical parabolic reflector to increase the radiation in the direction of the receiving antenna under test.

An IN23 crystal diode is used as the rf detector. It is mounted in a small shield box at the top of the mast and is connected directly to the test antenna, as is shown in Fig. 3. To facilitate changing model antennas for comparison purposes, a "plug-in" arrangement is used .

A minature polystyrene coil-form socket is mounted in the top of the crystal shield box and the feeding terminals of the antennas plug into the socket holes. The socket used makes a good connection to the No. 12 tinned copper wire of which the model antennas are constructed.

EFFECT OF MATCHING

Since the crystal is assumed to present a load of about 300 ohms, antenna feeding systems which match this impedance are employed. Impedance matching is not extremely critical, however, since the crystal is connected to the antenna without intervening transmission line. An impedance mismatch of 2:1 will cause only about 10 per cent error in the relative power indicated.

Such mismatches do not change the shape of the radiation pattern indicated, but do cause errors in comparing the power gains of various antenna models unless the degree of mismatch is the same for each.

PATTERN PLOTTING EQUIPMENT

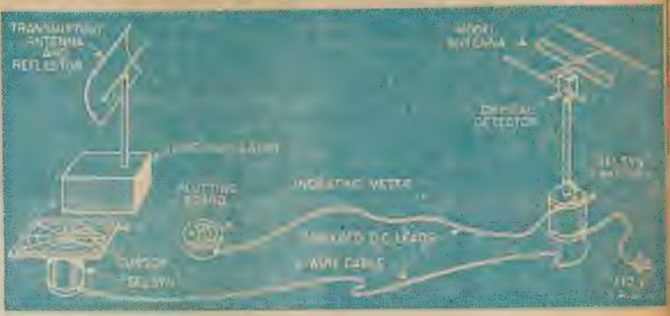


Figure 2. This diagram illustrates the complete set-up for measuring the radiation pattern of an aerial. Selsyn type motors simplify the operation but other means of rotating and checking the aerial setting could be devised. Many of the selsyn motors reaching Australian amateurs operate from 50 volts.

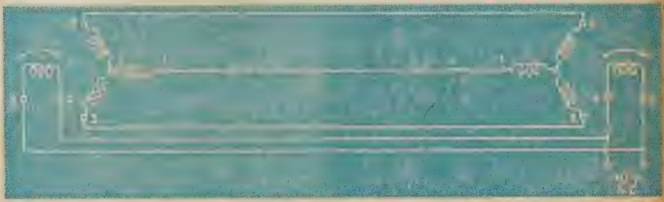


Figure 3. Corresponding terminals on the selsyn motors should be connected directly and the a-c input windings connected in-phase. They may be operated in parallel, as shown, or in series, according to the order of the voltage available.

For instance, valid comparisons may be made between the gains and patterns of complex arrays having 72 ohm feeding impedance and a centre-fed half-wave dipole having the same characteristic, impedance, although both mismatch the detector by 4:1.

The rectified dc from the crystal "receiver" is connected to a remote current meter (preferably a low range microammeter) by two flexibl wires which run down the inside o the brass tube supporting the tes antenna.

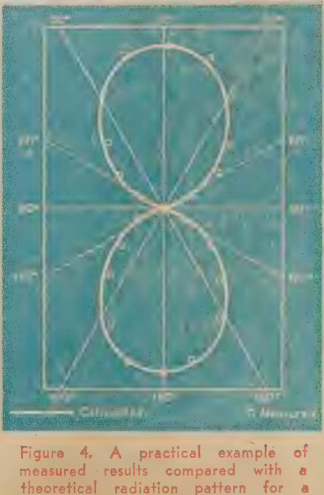


Figure 4. A practical example of measured results compared with a theoretical radiation pattern for a dipole. The two correspond very closely.

If the current is less than abou one milliampere, the reading of th remote indicating meter will be approximately proportional to powe received by the test antenna, sinc the crystal is a square-law detecto in the low current portion of it characteristic.

The power response of the crysta may be checked by comparing measured half-wave dipole patter with the theoretical dipole power pattern of Fig. 1. A typical comparison is shown in Fig. 4.

The selsyn motor which rotate the model antenna is controlled b a second selsyn coupled to it by lead about 15 feet long. The standar connections of a selsyn system ar given in Fig. 5.

PLOTTING BOARD

A plotting board, consisting of 9 by 12-inch piece of ¼ inch plywoo is mounted on the drive selsyn. Th selsyn shaft protrudes through th plotting board and through the centr of the polar co-ordinate paper, whic is thumb-tacked to the board

A radial scale, or cursor, is fastened to the selsyn drive shaft to ac as an indicator of the angular position of the model antenna, so that a the cursor is rotated on the grap paper, the selsyns synchronise th rotation of the antenna with it. Thus the angle of the polar diagram i automatically determined.

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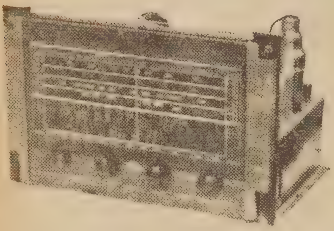

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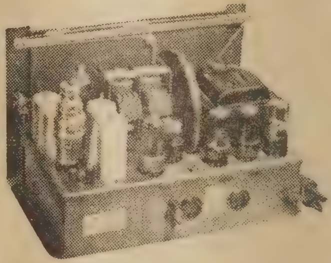

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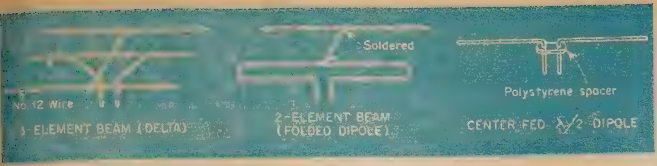

Figure 7. Examples of model aerials which may be checked on the equipment. For simplicity they can be made from heavy wire. Careful thought must be given to the subject of matching.

The other co-ordinate, the radius vector is read directly from the power indicating meter, and is plotted in arbitrary units from the centre of the graph.

Plotting an antenna pattern polar diagram is then merely a matter of rotating the cursor and plotting sufficient points, as defined by the angle of the cursor and the radius indicated on the meter, to determine its shape.

The details of the cursor are given in Fig. 6. It is made of thin aluminium or brass, and may be graduated with a scale similar to that of the meter used. This simplifies converting meter readings to radial distances from the centre of the plotting paper. It is also helpful to put small notches in the cursor arm at the positions of the major scale divisions, as this facilitates locating these positions with the pencil point.

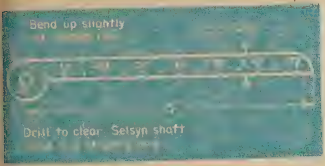

Figure 6. A suggested design for a cursor to be used in conjunction with the plotting board. It will grip the selsyn shaft but can be removed easily to give acess to the plotting board.

The cursor should be easily removable to facilitate changing graph paper. One simple way of accomplishing this is to drill the hole in the cursor large enough to clear the selsyn shaft, but file it slightly oval, Fig. 6.

According to scaling theory, a model antenna will perform exactly like its full-scale prototype in free-space if the element lengths, diameters, and spacings are divided by a given factor (called the "scale factor") and the operating frequency and element conductivity are multiplied by the same factor. Conductivity scaling is usually ignored.

As an example, suppose that it is desired to determine the characteristics of an antenna designed for the amateur 10-metre band, say at 28.5 Mc. Assuming that the pattern measuring equipment operates in the amateur band at 1220 Mc., the ratio of the frequencies, and hence the scale-factor, is 1220/28.5 or 42.75. This is the number by which all of the dimensions of the 28.5 Mc. antenna must be divided to result in a model which will give comparable performance at 1220 Mc.

The dimensions of any impedance matching system associated with the antenna should be scaled in the same proportion.

Having determined the dimensions of the model antenna, the construction is relatively simple. The "plumber's delight" type of construction may be used to advantage.

As mentioned above, only antennas having equal feeding impedances may be compared directly for power gain. Impedance matching systems of the folded-dipole, delta and "T" types may be used.

In using the pattern measuring equipment, the operator should be located at a remote spot, well out of the path between the transmitting and receiving antennas. If the transmitting antennas has a good reflector, the plotting board and meter may be located back of this, where a relatively field-free region exists.

In making pattern measurements indoors, reflections from walls or other objects directly behind the model antenna are sometimes troublesome. These reflections can be prevented by placing a large piece of sheet-metal at a 45-degree angle behind the test antenna to deflect the waves upward.

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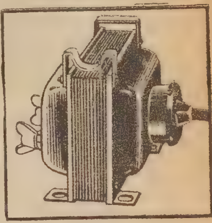

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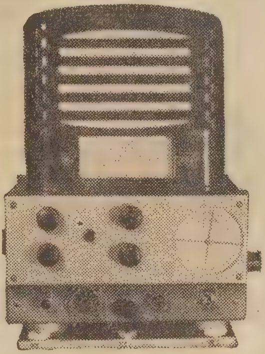

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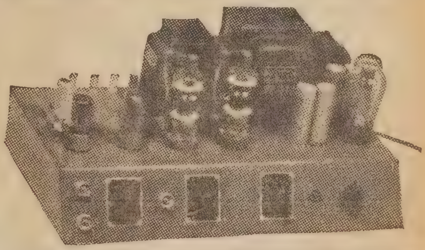

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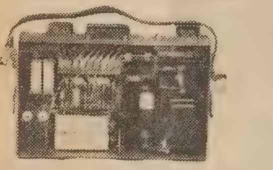


FS6 VIBRATOR SUPPLIES

6 volt D.C. input. Filtered H.T. output 290 volts tapped 175 volts at 100 M.A. 20 volt bias supply. A.W.A. gas-filled vibrator. Complete in shielded case, weight packed in original cases, 55lbs.
PRICE, Brand New, F.O.R. **£5/15/-**
Complete with Spare Vibrator.

PUSH BUTTON SWITCHES

5-pole each 2 pair of contacts. Made in U.S.A. Ideal for receivers, multimeters, etc.
Price, each . . **12/6**
Packing & Postage N.S.W., 9d; Interstate, 1/6.

DISPOSAL VALVES, TESTED

1K7G	8/6	852	25/-
3Q5GT	10/-	954	12/6
6AC7	14/-	955	12/6
6AG7	20/-	956	12/6
6B6G	10/-	9001	10/-
6H6GT	7/6	12A6	10/-
6SH7	8/6	12SG7	10/-
6SH7GT	8/6	12SK7	10/-
6SL7GT	12/6	12SR7	10/-
6U7G	10/-	EA50	7/6
6Y6G	12/6	CV6	8/6
7193	8/6	VT90 Micropop	10/-

NEW VALVES

1D8GT	15/-	7F7	11/6
6B8	15/-	83V	11/-
6F6	15/-	811	70/-
6G8G	12/6	813	70/-
6H6	10/-	828	35/-
6J5G	11/-	837	25/-
6J7G	12/6	866A	25/-
6K8G	12/6	879/2X2	15/-
6SQ7	12/6	1293	11/6
6X5GT	12/6	1294	11/6
7A6	10/-	VR54/EB34	5/-
7C7	11/6	VR65A	5/-

MULTIMETERS PATON TYPE M.C.A.

4" square 1mA meter, 1000 ohm per volt A.C. & D.C. 4 current ranges to 250mA, 4 voltage ranges to 1000 volt, 3 resistance ranges to 1.5 megohm.
Size 7½" x 6" x 2½".
Good Condition.

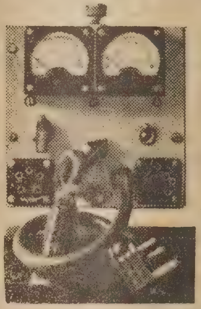
Price, each **£6/10/-**

Packing and registered postage: N.S.W 3/3; Qld., Vic., Tas., 5/6; S.A., N.T., W.A., 7/9 each.

SPECIALS

TR113 Transceiver, 100-124 mcs., with valves, less power supply, each	£8/10/-
TR1133 Genemotor, 12v. input, output D.C., 300v, 240 mA, 150v, 10 mA, 6v, 5A., filtered each	£4/10/-
AT5 Transmitters with valves less power supply	£8/10/-
BC375 Coil units, each	£3/10/-
TA12C 100 watt Transmitters less power supply and mod.	£14/10/-
W.E. F.M. Receivers 29-40 mcs. 10 valves less power supply	£17/10/-
A.W.A. U.H.F. Receiver 190-210 mcs. 11 valve, less valves and meter	65/-
ZB2-ARRI U.H.F. Receiver 234-258 mcs. 4 valves, complete, new	£4/15/-
Used	£3/15/-
Bendix RAXIODA remote control units. Each	35/-
24-volt solenoid 1 contact, 5 amp.	6/-
6-volt solenoid 1 contact, 5 amp.	6/-
4-pin wafer sockets, doz.	3/-
Aircraft S.P.D.T. Toggle Switches, ea.	2/6
Phone Jacks and plugs, pair	2/-
each	1/-
Co-ax Connectors pye type, pr.	3/-
Each	1/6
Vibrator "A" R.F. Chokes, each	2/-
685 Microhenry 500 mA. slot wound R.F. Chokes, each	1/-
High to low impedance headphone adaptors, each	4/6
Variable tone Buzzer Transformers, each	3/-
Headphones, low impedance, each	8/6
Headphones, high impedance, each	17/6
Output Transformers to low impedance headphones, each	5/6
Double Button Carbon Microphones. each	7/6
Carbon Throat Microphones, each	7/6
Carbon Microphone Inserts Carbon Diaphragm, each	2/6
Dynamic No. 7 Microphone Inserts, each	6/-
Shielded Hook-up Wire, per yard	8d
Westectors, each	4/6
Ceramic Formers 6 x 1½in dia., ea.	3/6
Ceramic Formers 6 x 3in. dia. ea.	5/-
Full Wave Bridge Copper Oxide Rectifier, 100 mA., each	3/6
Half wave Selenium 5 mA., Rectifier, each	2/6
1 inch Ceramic Standoff Insulators, each	1/-
¾ inch lead through Insulators, ea.	1/-
Pressure Gauges, 2½ inches, 3000lb. sq. inch, each	25/-

TWIN METER CONTROL UNIT



Comprising: 2 imported 2 inch flush mounting meters, 0-5 mA., D.C. and 20v. D.C.; 2 7,500 ohm potentiometers; 7 position 10 amp. rotary switch; S.P.-S.T. toggle switch; plugs, sockets, shock mounts, etc.

Price, ea. **37/6**

Packing and Registered Postage, N.S.W. 1/9; Qld., Tas., Vic., 2/9; S.A., W.A., N.T., 3/9.

METERS

0-30 mA. D.C. 3-inch round flush	25/-
0-30 volt D.C. 3-inch round flush with datum indicator	30/-
0-30 mA., R.F. thermocouple. New	15/-
0-1 amp. R.F. thermocouple. New	15/-
Used	10/-
0-3 Amp. R.F. Thermocouple, New Imported 2" square flush	17/6
0-4 Amp. R.F. Thermocouple, New Imported 2" square flush	17/6
20 mA. DC 300 amp. scale, 3in. round flush	25/-
20 volt DC 2in. square flush, imported	20/-
40 volt DC 2in. square flush, imported	20/-
40 amp. DC 2in. round flush, imported	30/-
20 volt and 200 volt DC 2in. round dual reading with leads	20/-

Packing and Postage, 1/6 each.

GENERATORS

24 volt 60 amp. D.C. (F.O.R.). Each **£11/10/-**

12 volt 60 amp. D.C. (F.O.R.). Each **£9/10/-**

Ideal for home lighting plants, battery charging, plating, etc.

COAXIAL CABLE

Polystrene Insulation

PS 11/M 72 ohm., 60ft. lengths. Only 5/16 inch O.D.
Price, per length **30/-**

Packing and postage: N.S.W., 1/6; Qld., Tas., Vic., 2/6; S.A., W.A., N.T., 3/6.

4W FLUORESCENT LAMPS

Colour: Blue. Length, 5¼ inches. Ideal R.F. indicators.
Price, each **2/6**

Per doz. **25/-**

Packing and postage 6d each.

ELECTRONIC EQUIPMENT CO.

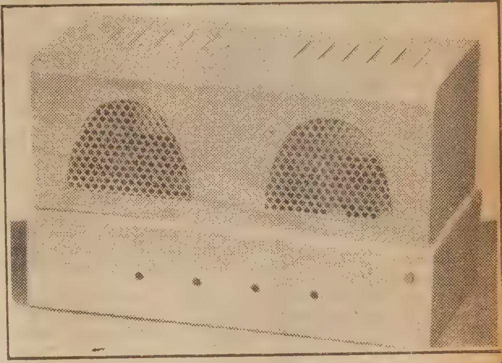
Please add exchange to all cheques. Make money orders and postal notes payable at Lewisham. Sorry, no C.O.D.

LM3555—29b West St., Lewisham, Sydney. OPP. END OF LEWISHAM HOSPITAL (ADJOINING RAILWAY LINE) **LM3555**

TRADE REVIEWS AND RELEASES

A UNIVERSAL CHASSIS FOR LARGE AMPLIFIERS

Intending constructors of large amplifiers will be particularly interested in a chassis kit recently released by Homecrafts Pty. Ltd. It makes possible a "finished" appearance in custom built equipment.



MEASURING approximately 17 x 9 x 4½ inches, the chassis has a removable punched top and a removable base plate, to which feet can be attached, if desired.

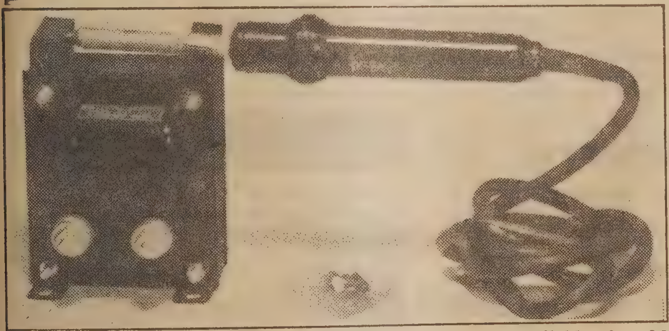
The top plate is punched with a pattern of standard valve holes, so that many circuit and layout variations can be accommodated. A large filter choke and an output transformer can be mounted over certain of the holes, if required, while there is also a position for a heavy duty power transformer.

Four control positions are available on the front of the chassis, while the rear and side provide outlets for speaker and power. Unused holes can be covered with disguise plates, although this is unimportant, since the whole chassis is closed in by a removable cover.

This cover has frets at front and rear and it is louvred at the top for maximum ventilation. It is attached readily by four screws. The finish is in grey crackle lacquer.

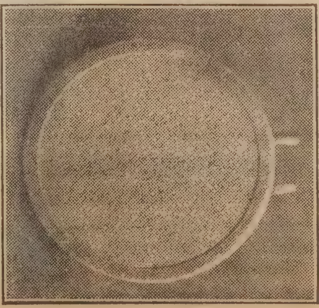
Supplies of the chassis are available from branches of Homecrafts Pty. Ltd., in Sydney, Newcastle and Melbourne. Retail price is £4/19/6

"SCOPE" INSTRUMENT IRON



ILLUSTRATED above is the new "Scope" instrument iron, especially intended for fine work. It will operate on a-c or d-c between 2.5 and 6.3 volts, heating time on 4 volts being slightly under six seconds. Two spare composition elements and a spare tip are provided, but additional units are available for 9d each. Retail price of the iron is 43/6, while the transformer can be supplied separately for 30/6. The iron is ideal for general and auto servicing, since it heats instantly and draws no current when not in use. (W. J. McLellan and Co,. 55 York Street, Sydney.)

A WIDE RANGE CRYSTAL INSERT



OF special interest to amateurs and public address operators is this new Acos crystal microphone insert, "MIC. 19." Known as the "Sintercell," it is similar to inserts previously released but features a special acoustic filter, which gives an essentially flat response from 40 to 8000 c/s. It is hermetically sealed, robust, and wind-proof.

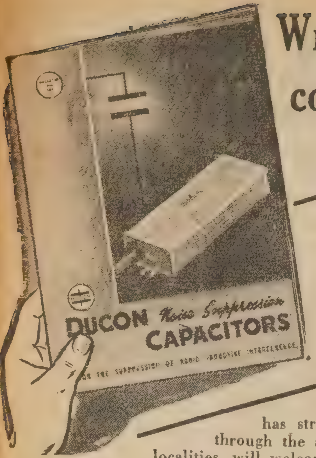
Best results are had with the element horizontal, so that the insert leads itself to mounting in "sound cell" type cases. Distributors are Amplion (A'sia) Pty. Ltd., 36-40 Parramatta Road, Camperdown, NSW. Retail price is £2/15/-.

40-WATT BALLAST CHOKE

A RECENT addition to the Ferguson line is this 40-watt ballast choke intended for use with fluorescent lighting systems. A standard catalogue item and listed as CF114, the choke should be available through all Ferguson distri butors. Retail price is £1/1/-.

The choke carries no mountin feet and is unfinished in regard t lacquer, &c., the normal procedur being to seal it into the assembl with pitch, which provides ph[illegible] protection as well as prev[illegible]tin lamination hum.

The inductance is 1.1 H., at 5 c/s, the d-c resistance 23 ohms, th current rating 375 mA. Power facto correction condenser for the chok is 4 mfd.


DUCON Noise Suppression CAPACITORS
FOR THE SUPPRESSION OF RADIO DOMESTIC INTERFERENCE

Write for your FREE copy NOW!

DUCON
Noise Suppression
BULLETIN

The suppression of radio interference is very much to the fore in these days of high fidelity sets. Anyone who has struggled to obtain satisfactory reception through the appalling noise which can exist in bad localities, will welcome the attempts which are being made to combat such disturbance.
Ducon offers this booklet in the hope that, by so doing, radio users and those interested in the successful merchandising of Radio will find something of interest, and, perhaps assist in the efforts being made to reduce interference. In many cases the interference can be remedied at the source, and it is mainly with this phase of the problem that the Ducon Company can be of service.

DUCON Capacitors

DUCON CONDENSER LTD.,
73/91 Bourke St., Waterloo. MX1441.
Please forward me without obligation my FREE copy of "Ducon Noise Suppression Bulletin."
NAME ....
ADDRESS ....
....

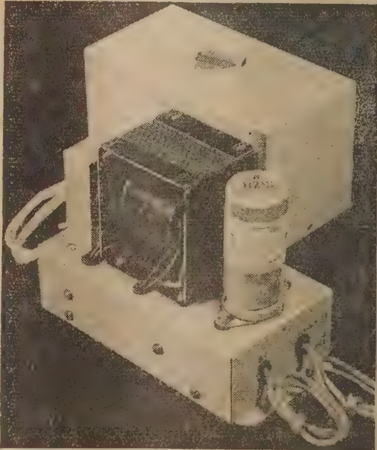
MAGNETIC P.U. CARTRIDGE FROM GOLDRING

GOLDRING ENGINEERS have succeeded in producing a small magnetic pickup cartridge which will directly replace many flat type crystal cartridges now in use. It measures 1 5-8in x ¾in x 7-16in, and has two ½in centre mounting holes. It can, therefore, be installed with little or no alteration in many pickup arms, bringing the advantage of light weight and added compliance.

Using a replaceable miniature sapphire stylus, it is virtually a needle-armature movement, and the stylus can be changed with the fingers. Stylii are available for either standard 78 rpm or long-playing discs, it being assumed that the arm will be suitably counter-weighted when the latter are being played. It is claimed that changing the sapphire gives no ill-effects, since the negligible wear of a lightweight head and frequent changing gives no chance for the jewel tip to develop a damaging "flat."

Frequency range of the cartridge is stated as 30-1600 c/s, coil impedance 3000 ohms, optimum load 50,000 ohms and the output 150 millivolts.

Available from all Goldring distributors, the head will retail for 63/- complete in a box with a standard stylus and one for long playing records. Replacement stylii are available for 15/-.



The Quality Aegis Components!

VIBRATOR UNITS

TYPES VP1 & VP1A

SPECIFICATIONS:

Completely filtered vibrator units, using an Oak Vibrator — constructed of high-grade components, ensuring long life and completely dependable service. Nicely finished in Grey Duco, as illustrated, and typically an Aegis quality component.

TYPE V.P.I.A.
Input: 6.3 volts D.C. at 9 amps.
Output: 170 Volts D.C. at 17 M.A., completely smoothed.

TYPE V.P.I
Input: 6.3 Volts D.C. at 3.85 amps.
Output: 250 Volts D.C. at 50 M.A., completely smoothed.

Enquiries Invited for 12 and 32 Volt Units.

ATTRACTIVE DISCOUNTS AVAILABLE TO THE TRADE

AEGIS MANUFACTURING COMPANY PTY. LTD
208 LITTLE LONSDALE ST., MELBOURNE

Aegis Quality Components are available from selected Wholesalers throughout Australia.

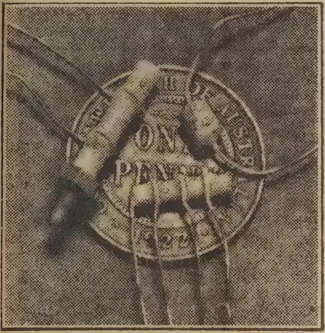
NEW LINE OF CONDENSERS

WITH an eye particularly to the television market, the United Capacitor Company has introduced to the Australian market a complete new line of fixed condensers.

Most interesting from the experimenters' point of view are the miniature ceramic condensers, some of which are illustrated full size below.

At the top right is a 100 pf. single unit, while on the left is a twin 1000 pf. condenser suitable for bypassing, for example, the cathode and screen of a single H.F. amplifier stage. The earth connection is made through a single-hole mounting screw.

At the bottom is yet another type having three 1000 pf. units and a single common earth connection. Voltage rating on these and similar condensers is 500 D.C., while the normal capacitance tolerances also apply.



In addition to these lines, the company is making available special high-voltage filters for C.R. tube supplies, mica bypass condensers for high voltage transmitter bypasses, as well as normal can-type filter condensers in a variety of ratings.

The components will be handled by trade houses. Trade inquiries to the United Capacitor Company Pty. Ltd., 53 Carrington Road, Marrickville, NSW.

MULLARD VALVE MANUAL

TO assist designers and service engineers, Mullard-Australia Pty. Ltd. are making available limited supplies of a new valve data manual listing details of standard Mullard English types.

The book contains a reference index, followed by a general guide to valve type numbers, applications, requirements, &c. Then follow data in list form concerning receiving and miscellaneous valve types, obsolete types, basing and equivalents. This section gives information, also, on recently developed V.H.F. and transmitting tubes, voltage stabilisers, photoflash units, photocells, and &c.

It concludes with a collection of handy abacs and reference data.

Price is 8/6 post-free and the book can be obtained from the head office of the company at 35-43 Clarence Street, Sydney, or from Mullard distributors.

"KINGSLEY"

We take great pleasure in announcing to the many satisfied users of "Kingsley" components that new stocks, including the famous Coils and I.F. Transformers, are now available through our Authorised Distributors.
IMPORTANT NOTE! These components are not substitutes or imitations, but are genuine "Kingsley," produced under the same technical supervision, and with the same efficiency.
In that "Hobbies" set you are going to build, use genuine "KINGSLEY" QUALITY COMPONENTS, and be certain of outstanding performance.

KINGSLEY RADIO
3 CORNELL PLACE, CARLTON, VIC. FJ5409

EVERY FAMILY
NEEDS A
SECOND RADIO

And you can use a portable radio anywhere!

The most powerful batteries are
EVEREADY
TRADE-MARKS
MINI-MAX
PORTABLE RADIO BATTERIES
— they last longer, too!

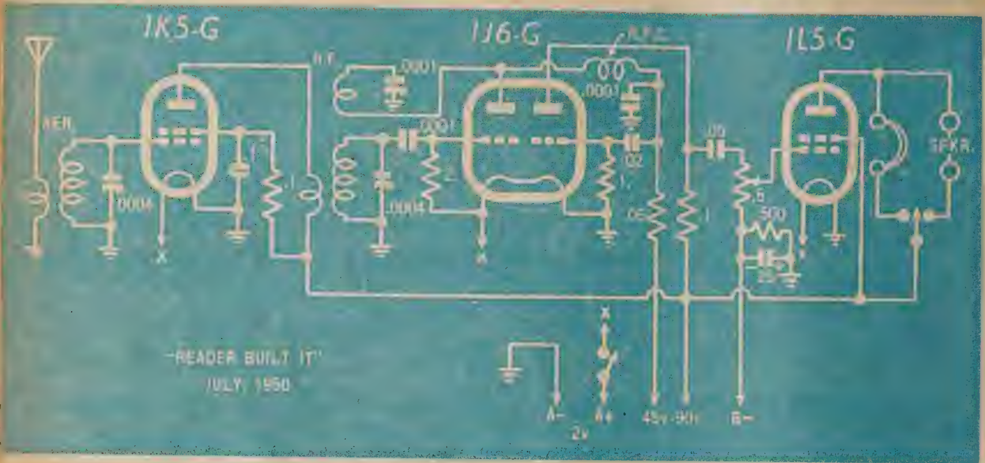
EVEREADY
MINI-MAX

EM50-3

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A THREE-VALVE T.R.F. BATTERY RECEIVER



Though large receivers and amplifiers have their place in the scheme of things, the rising generation of enthusiasts is as keen as ever on the more simple and inexpensive circuits. Here is a design, which you may like to try out, sent in by a Queensland reader.

THE contributor is Mr. C. M. McFarlane of Tanbar Station, Vindorah, Qld. His remarks about he circuit are very brief but there s no reason why it should not give xcellent results.

The circuit provides for a 1K5-G alve as an R.F. amplifier, with no rovision for gain control. This vould lead to no difficulty in remote reas, since incoming signals would ot be likely to overload the R.F. mplifier of the detector following.

OSSIBLE OVERLOAD

Close to a powerful station, there vould be a possibility of overload nd this might necessitate using a horter aerial or arranging for otentiometer control over the creen voltage. Don't forget, however, that if a potentiometer is conected across the high tension upply, it would be essential to reak the circuit when the set is ot in use, to prevent a constant rain being imposed across the atteries.

Any one of a number of R.F. entodes could be used in this position, ranging from the old 32 or 34 to the more modern 1M5-G, or 1K5-G as specified. The latter valves are available from disposals dealers for as little as 5/- or 7/6.

HIGHER VOLTAGE

As it is, the screen voltage suggested by the circuits is unnecessarily low and, with a supply voltage of 90, it would be possible to decrease the screen supply resistor from 0.1 meg. to as low as 25.000 ohms. The lower value of resistor will give more R.F. gain at the expense of an extra milliamp or so of battery drain.

The R.F. amplifier is coupled to the detector through a standard R.F. coil with reaction, and the detector circuit itself is quite straightforward. Trimmer condensers would have to be connected across each section of the tuning gang for alignment at the high frequency end of the band. The aerial and R.F. coils should preferably be of the same brand to ensure reasonable tracking of the tuned circuits.

Being a standard battery set, Mr. McFarlane has chosen to operate the detector from the 45 volt tapping on the B-batteries. Actually, the bottom end of the plate feed resistor could be run to B-plus 90 volts through another .05 meg. resistor, the junction of the two resistors being bypassed with a condenser having a value somewhere between 0.5 and 8 mfd.

The second section of the 1J6-G operates without negative bias—a condition which is permissible in a high-mu valve of this type. However, there is a chance that rather better results would be had by providing about -1.5 volts of bias from a torch cell clipped on to the chassis.

VOLUME CONTROL

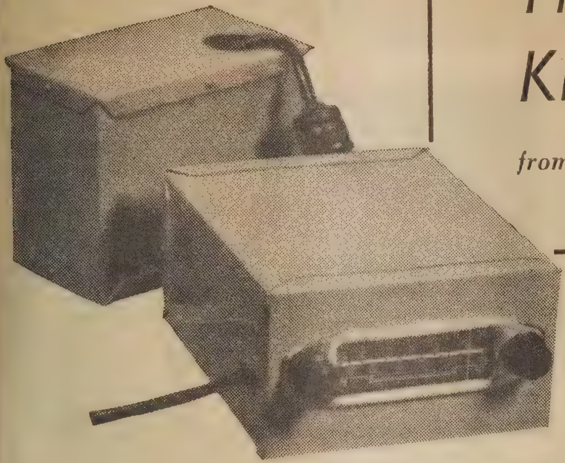
Another point is that the volume control could well be brought forward to this grid circuit instead of being left in the grid circuit of the 1L5-G. In this latter position it could not prevent overload and distortion in the first audio stage with a strong input signal.

Back-bias is provided for the output valve, the bias resistor obviously being chosen to effect a compromise between power output and battery drain. If more power is required, the resistor could be reduced to 400 or even 300 ohms.

The speaker-to-phone switch is obviously an optional feature.

Three Popular Kits . . .

from the Electronic Parts range . . .



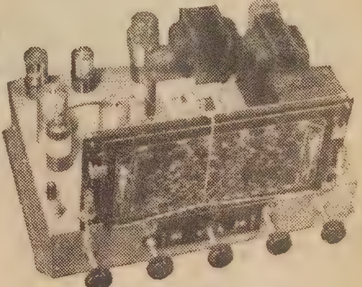
Here are three entirely different types of kits taken from our wide range which have proved extremely popular. This is because of their excellent performance (due to sound design plus first grade components) and reasonable price.

KAR SET

("Radio & Hobbies," May, 1949) A neat, compact, 5-valve car radio, designed for 6 or 12 volt operation. One of the most efficient car radio designs produced in this country. We include valves, chassis, boxes and all best quality parts in our quote. Because placement and type of speaker and aerial varies, these items are not included in the kit £17/4/-
Extra for 6" Per Mag. Speaker, Metal Speaker Box, and 6ft. 3-piece side mounting (or fender mounting) aerial £4/11/-

THE 1950 RADIOGRAM

("Radio & Hobbies," Jan., 1950) For the man who wants a highly sensitive A.C. receiver, plus facilities for using one of the modern lightweight gramophone pickups, this radiogram must be the choice. Although it employs seven valves, the use of two 6SN7GT twin triodes gives it 10-valve performance. The additional stages introduced by these twin triodes provide the necessary degree of pre-amplification and bass boost so necessary with modern high-quality pickups. Power output is more than adequate for domestic use. Price for complete kit, including valves, Rola or Amplion 12in. speaker and all best quality parts (Gramo-motor and pickup extra) £26/3/-



1950 RADIOGRAM

FIRESIDE 5 DUAL WAVE

("Radio & Hobbies," Aug., 1946) Most attractive in appearance and efficient in performance. A 5-valve D/W A.C. kit in two-tone leatherette-covered cabinet with easily readable straight-line dial, and complete with valves, 5 inch speaker cabinet and all first-grade components £16/8/-

FIRESIDE 5

FIRESIDE 5 BROADCAST

("Radio & Hobbies," Sept., 1946) Same as D/W but for B/C reception only, with loop aerial £15/18/-
Freight only is additional to prices quoted above.

If you have in mind some other kit such as a portable, vibrator, battery, 32 volt kit, or any normal design you are sure to find it in our free kit-set catalogue, where more than 50 high class kits are listed. Send coupon for a copy. (Please enclose stamps to cover postage).

Decide to make yours an "E-P" kit, and be certain of satisfaction. Post your order NOW!

To Electronic Parts Pty. Ltd.

Please send me your kit-set catalogue.

Name: .. ..

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E.S. and A. Bank Building,
BROADWAY, SYDNEY, N.S.W.
Phone: MA1661.
Telegrams: ELECPARTS, SYDNEY.

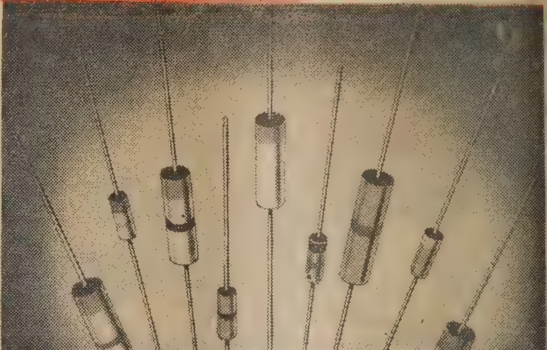
MORGANITE RESISTORS

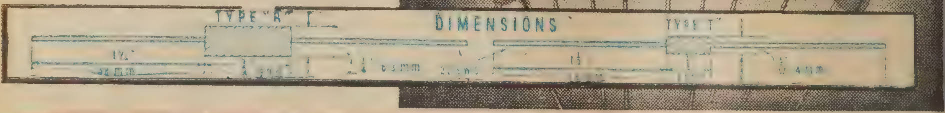
TYPES T and R

These moderately-priced BRITISH Resistors combine high performance with unusually small size. They are made accurately to their stated resistance values and are consistently stable.

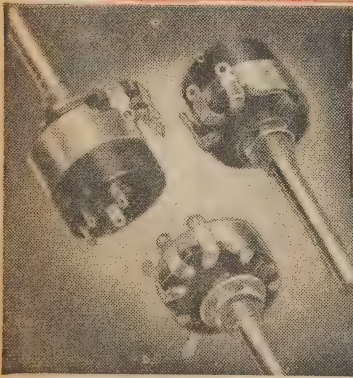
The simple construction of Morganite Resistors provides small, robust, light weight components of high power dissipation and low operating temperatures, and are colour coded to RMA Standard.

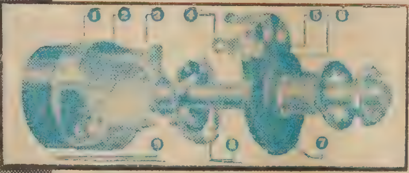
Stocked in preferred Standard values, viz., 10—12—15—18—etc., values rising in 20 per cent steps (approx.). Morganite Resistors Preferred Value Ranges are standardised in U.S.A. and U.K., and are now available in Australia.





MORGANITE MINIATURE POTENTIOMETERS





New in design . . British made . . and fully incorporates the traditional Morganite standard of quality.

Radio engineers will appreciate not only the small compact size of the Morganite Potentiometer, but the fact that it is available with a single or double pole switch of proved Morganite reliability.

SPECIFICATIONS

1 Overall diameter 1 1-8".

2 Double pole or single pole switch operated from shaft.

3 Pressure diecast rotor and shaft for accuracy and strength.

4 DOUBLE CLENCH TERMINALS eliminate noisy joints.

5 Same track design for switch and non-switch type enables interchangeability. Switch type converted to non-switch by interchanging covers.

6 The renowned MORGANITE RESISTOR TRACK LOW noise, hard wearing, wide range of standard resistance values and gradings. Rating ¼ watt.

7 Standard position fixed tapping available.

8 Double prong SPRING CONTACTS, in special non-tarnishing metal for resistor sweep, maintains correct pressure for minimum noise without wear.

9 The switch withstands the most rigorous operating conditions. Rating: 2 amps, 240 volts.

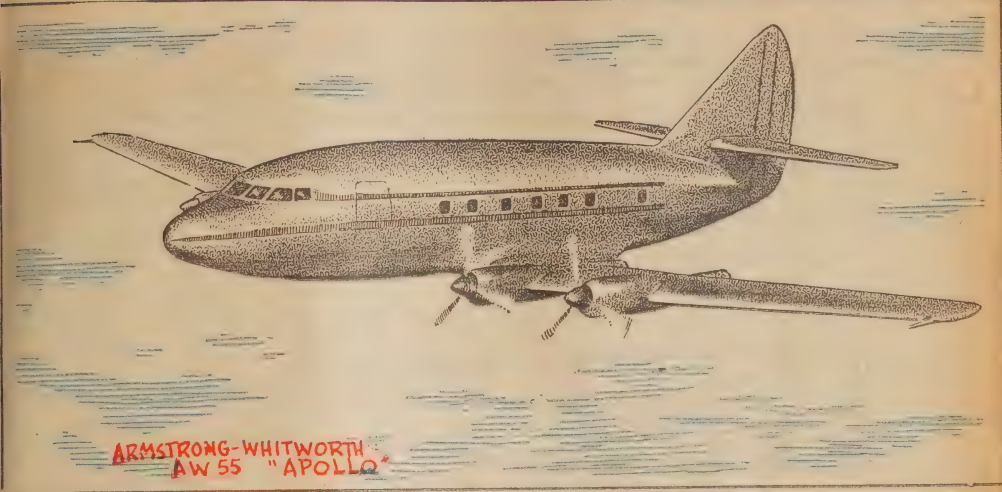
10 Instrument QUALITY at LOW Prices.

THE MORGAN CRUCIBLE CO. (AUSTRALIA) PTY. LTD.

BOURKE ROAD, ALEXANDRIA, N.S.W.

TELEPHONE MU1371 • CABLES & TELEGRAMS "MORGANITE," SYDNEY

A NEW TURBO-PROP. AIRLINER



Designed as a fully-pressurised transport for medium-stage general purposes, the new Armstrong Whitworth AW 55 "Apollo" is one of the most interesting British civil airliners to appear for some time. Technological advances and orthodox practices have been successfully blended to produce an aircraft of conventional layout and appearance, but with turbo-prop power units, fuselage pressurisation and a form of wing structure giving high tortional rigidity.

THE prototype Apollo first flew in April, 1949, and experimental flying has continued since.

Designed to comply with the type 11B specifications of the postwar Brabazon Committee, the Apollo is a 24-31 seater passenger aircraft with a top speed of 345 miles an hour and a maximum range of 1000 miles at its operating height of 20,000ft.

CLEAN DESIGN

With its fuselage of circular cross-section, the aircraft is of particularly clean design, its gas-turbine engines fairing into the wing thickness.

A low-wing all-metal monoplane, the Apollo features a device known as a "gust alleviator." This device allows both ailerons to move upward under the influence of an up-gust, and so damps out the effect of upward acceleration on passengers and crew.

The wings are each made up of a centre section and a tapering outer wing. The outer section shows 6 deg. dihedral. Fowler-type flaps are fitted inboard of the ailerons, and provision is made for thermal de-icing.

The tail unit is of the cantilever monoplane type, with the tailplane mounted at the level of the top of the fuselage and so clearing the engine exhaust. The fin is large and a two-piece rudder is fitted, the rear part of the rudder functioning in the normal manner up to angles of 10 deg., beyond which further movement automatically brings into operation a hydraulic transmitter that moves the forward part of the rudder.

Retractable tricycle-type landing gear is fitted, all three units having twin wheels. Hydraulic retraction raises the main wheels inward and the nosewheel backward into the fuselage base.

UNDERCARRIAGE

Use of turbo-props and Fowler flaps called for great ingenuity in designing the main undercarriage and flap actuation. The small diameter of the power units made it impossible to house the wheels in the nacelles, and consequently the wheels retract sideways.

The four Armstrong-Siddeley Mamba airscrew gas turbines each develop 1010 airscrew shaft horsepower plus 307lb net jet thrust for take-off. Three-blade propellers are fitted.

Alternative power plants may comprise four Pratt and Whitney air-cooled radials of 1200 horsepower (Apollo II) or four Rolls-Royc liquid-cooled Merlins (Apollo III).

A flight crew of four is normall carried.

Normal seating is for 24 passenger in pairs each side of the centra gangway in the passengers' compartment. Accommodation can be increased to 31, however. Three baggage compartments are provided.

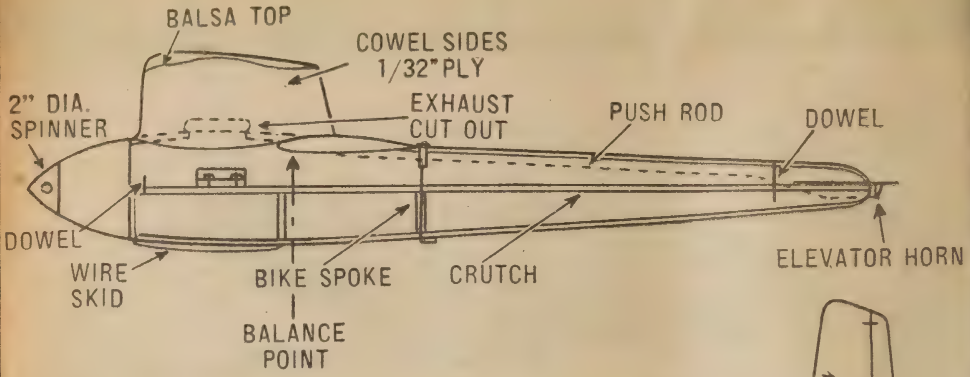
The entire crew and passenger accommodation is air-conditioned an pressurised to maintain 8000ft atmospheric pressure at 25,000ft. Fro distribution ducts running below th cabin floor, air is led up the fuselag walls to enter the cabin at wal ceiling level through louvred grille

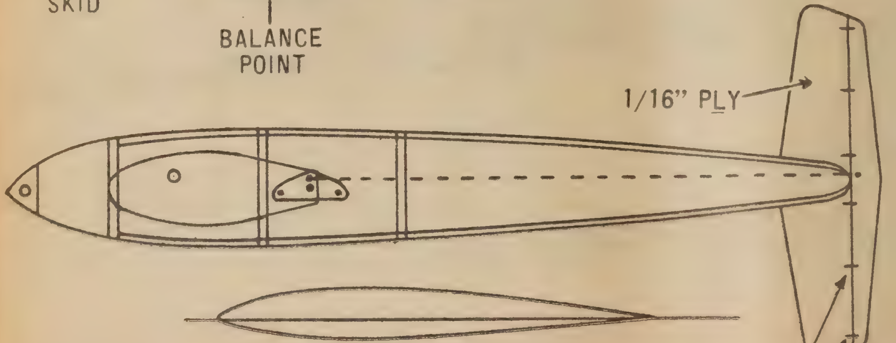
Top speed of 345 miles an hour at 20,000ft, where the cruising spee is from 275 to 306 miles an hou Stalling speed, with flaps down, 75 miles an hour.

WEIGHT FIGURES

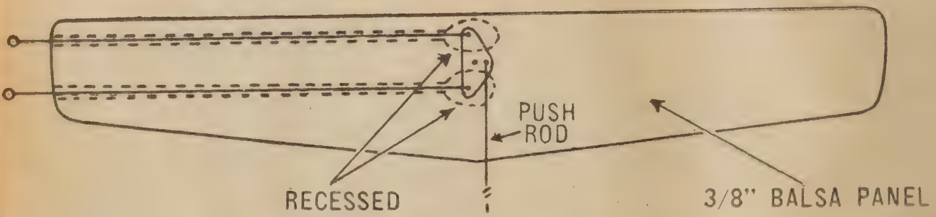
Weight of the Apollo, empty, set down at 23,310lb. All-up weig is 39,000lb, giving a wing loadi of 40lb to the square foot on t gross wing area of 986 sq ft. Pa load is 7000lb.

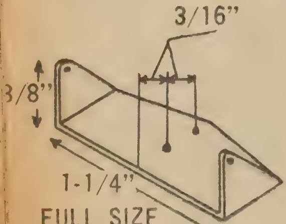
Main dimensions of the Apo are: Wingspan, 92ft; length, 71ft; a height, 25ft.


BALSA TOP
COWEL SIDES 1/32" PLY
2" DIA. SPINNER
EXHAUST CUT OUT
PUSH ROD
DOWEL
DOWEL
WIRE SKID
BIKE SPOKE
CRUTCH
ELEVATOR HORN
BALANCE POINT

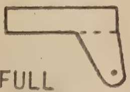

1/16" PLY
COPPER WIRE HINGES

AIRFOIL SECTION AT CENTRE

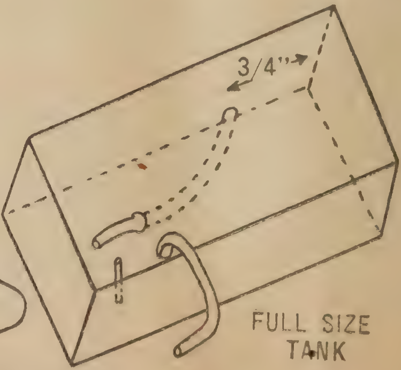

PUSH ROD
RECESSED FOR BELL CRANK
3/8" BALSA PANEL



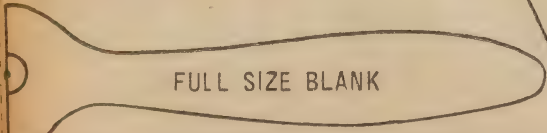
FULL SIZE BELL CRANK



FULL SIZE ELEVATOR HORN



FULL SIZE TANK



FULL SIZE BLANK

1/2" THICK AT HUB TAPERED TO 3/16" AT TIP

B-CLASS CHAMPION TOPS 100 M.P.H

Perhaps you've envied the owners of real speed models, as they roared along at better than 100 mph. Jack Finneran gives you the chance this month of building just such a plane with this description of his own B-class champion. Even if you are not ready to begin work right away, keep the article aside for future reference.

THIS month I have chosen something more ambitious, something more specialised than has been my custom in previous issues.

The plane I am about to describe has been a consistently good performer over the last eighteen months. On May 20 this year it won for me the Class B speed championship of New South Wales with a high speed of 103.6 miles per hour.

It shares with another of my planes the Australian speed record for its class and thereby hangs a tale.

I had an imported American all-metal kit plane which I had assembled and flown to a speed of 106.9 miles per hour—the Australian record for the class.

However, I chanced to overhear a remark that this performance was of little credit to me. Then and there was born a determination to equal or exceed the performance of the American machine.

Back home at the drawing board, surrounded by all the "gen" I could gather on the subject, I went to work. I culled over this and that design and noted down all the desirable features of each. I wanted a consistently fast and reliable machine; one that was not too hot to handle.

It's not much good having a job that is fast once in a while, or so difficult to fly that you "prang" all too frequently on landing.

Well, this machine is the culmination of that effort, and it has been flown for over eighteen months now from various fields, both good and bad. It has never sustained any damage other than the occasional broken propeller which is a legacy of all speed models.

On May 20 it was opposed by an impressive array of determined speedsters using the latest high speed American motors, but once again its consistency won the day and the NSW championship.

This ship has rarely flown under 100 mph. It is very easy to fly and land, and lastly, and very importantly, it is very easy to build.

CONSTRUCTION

In the following pages I will endeavor to explain fully its construction. Should you build it and have any problems write me c/o Radio and Hobbies and I will endeavor to help.

The key to the whole construction is bound up in the drawings which are one-third full size. I feel that your best plan is to do a set of drawings scaled up to full size as these will be of immeasurable help in the construction of the machine

I personally always follow those lines when building, even though I may do only rough drawings to work from.

I usually build the fuselage first. You can commence by making the hardwood crutch which extends the full length of the fuselage, and which is shown shaded in the drawings. This crutch is best made of coachwood or maple, and is cut to outline with a coping or fret saw so as to maintain shape.

Use a panel of straight grained material 5-16 inch thick for this crutch and screw, and glue the cross pieces in positions as indicated in the drawings.

Small wood screws are used. It is preferable to use a hot wood or casco type glue. Ordinary model cements are unsatisfactory because the fuels used in the engine act as a solvent and weaken them.

MUST BE DRY

When the crutch—which is really the backbone of the model, and which keeps perfect alignment of wing and tail and also takes the shock of any bad crash—is perfectly dry, you cement on it a suitable block of medium balsa in place, once again using the glues previously mentioned.

by Jack Finneran

While these are drying you can draw the side and top views on another medium balsa block which is to become the top half of the fuselage. Cut the surplus wood away with a coping saw. Then, using a keen knife, shape this block to a semi-circle cross section and roughly sand smooth.

Having completed the external outline it is now necessary to hollow out the inside. For this work a wood gouge is indispensable. Working carefully, remove the surplus balsa until you have also a semi-circle cross section inside, with a wall thickness between inner and outer surfaces of about ¼ inch

You may now lay this top piece aside and recommence work on the bottom half.

Draw the side outline on the balsa block, which is cemented to the crutch, and shape in a manner similar to the top half. Cement the three-ply nose piece in position and also screw in place. You can now hollow out the bottom half of the fuselage the same way as you did for the top However, leave the fuselage soli under each crutch cross piece as these take the landing loads and reduce the possibility of the fuselage bottom crushing due to a heavy landing.

You will note that the two fuselage halves are held together by a bicycle spoke and nipple. These should be added now and the two halves bolted together. In all probability you will find some discrepancies in outline between the two halves. These should be removed now with varying grades of sand paper

FINISHING TOUCHES

Smooth up the inside of the fuselage with sandpaper, too, because smoothness is vital to a good paint job, and on a speed model, one needs as good a paint job inside as outside. Th paint is the only protection the woo will get against the ravages of th fuel mixtures used in racing mode aeroplanes.

The fuselage is virtually finishe now with the exception of the helmet type cowling.

To arrive at a satisfactory fit u of the cowl you will first have t mount your engine in the botto half of the fuselage. Remember th exhaust stack on the engine has t be cut off flush with the fins s it will be possible to attach and detach the top half of the plane.

The drawing shows how four 1-8in bolts are fitted through the crutc to bolt the engine down in plac Having fitted the engine to the bottom half you now cut a hole in th top of the fuselage so as it can com down over the engine.

Lay the fuselage and engine asid now, as we can't attach our cowlin until the wing is fitted to the to half of the fuselage.

Now for the wing. Here extrem care is necessary because a tru warp-free wing is a "must." Perha you will get away with a slight wa in slow models but don't ever gamb on this with a speed model.

THE WING

For wing material I always u a stiff speckle grained piece of bal of about medium grade. Speckle, "quarter grain" balsa as it is calle is very stiff and resistant to warpage.

Take a three-inch wide panel 3-8-inch thick balsa and taper shown on the plans. Then taper

A MAGNETIC HIGH FIDELITY CARTRIDGE

to replace CRYSTAL CARTRIDGES

PLAYS STANDARD AND LONG PLAYING RECORDS

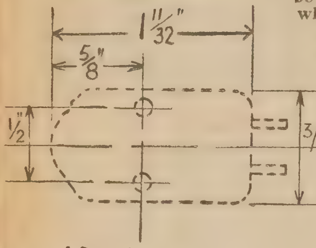
A new Magnetic Cartridge supplied with 2 sapphires, one to play standard and the other for Microgroove records, will be available to owners of pickups using the American standard ½in. centres for screwing crystal cartridges to the pickup arm.

THIS COVERS PRACTICALLY ALL AMERICAN, AUSTRALIAN AND ENGLISH CRYSTAL PICKUPS.

THE "GOLDRING" MAGNETIC CARTRIDGE No. 150 is a really high-class reproducing unit with a frequency range from 30 to 16 thousand cycles and a surprisingly high output in relation to its quality.

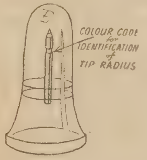
The weight of it is only 14grms., and it combines durability, true high-fidelity reproduction, high output and easy stylus changing when playing standard or Microgroove recordings alternatively.

The overall size is only 1 11-32 x ¾ x 7-16in. The sketch below, which can be cut out and placed into your pickup arm, will make sure beyond doubt whether it will fit your pickup arm.



ACTUAL SIZE

Cut out on dotted line to make sure cartridge will fit your pickup arm.



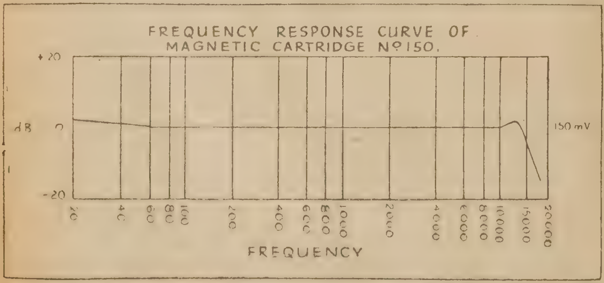
DAMPING: One of the unique features of this cartridge is the following: The stylus is at the same time the armature and is embedded in a non-ageing damping system. It is very light and rigid and weighs less than 0.1grm. In addition, the special damping and suspension system allows the stylus to move freely in all directions and the sapphire can find its correct position and automatically eliminate the residual tracking error inherent in most pickup arms. As a result, wave form and transient response are exceptionally good.

CHANGING OF STYLUS: The stylus of the Magnetic Cartridge can be withdrawn with two fingers without the use of tools and another stylus inserted in two seconds. While we advise, in the case of heavier pickups, against removing sapphire needles before they are worn, exhaustive tests have shown that frequent changes of the stylus in the Magnetic Cartridges No. 150 will prolong the life of the sapphire point by about four times. The reason is that wear of the sapphire in a very light pickup takes place gradually and frequent taking out and putting in of a stylus will keep the point round without allowing the record wearing flat to develop.

STYLI: All styli are colour-coded and the cartridges are being supplied with the blue stylus with a tip radius of .003 thou. for standard recordings, and the yellow stylus with a tip radius of .001 thou. for microgroove recordings. Also available are green style with a tip radius of .0025 and orange style .0035 thou. Price of these, as well as all replacement styli, is 15/-.

WEIGHT ADJUSTMENT: It is up to the ingenuity of the user to provide the necessary weight adjustment, that is, playing standard recordings as nearly as possible with 14grm. needle pressure and Microgroove recordings with 7grm. Experience shows that most users will not find it difficult to fit springs between arm and pedestal to provide this adjustment.

PRICE OF MAGNETIC CARTRIDGE No. 150: Complete with two sapphire styli, 63/-.



SPECIFICATION

Output (at 3.16 cms/sec. RMS velocity)	150 millivolts
Frequency Range	30-16,000 cps.
Stylus pressure 78 RPM	14grm.
33 1-3, 45 RPM	7grm.
Coil impedance (at 1,000 cps).	3,000 ohms
Coil resistance	2,000 ohms
Optimum load	50,000 ohms
Cartridge fixing, standard	½-inch centres.
Cartridge weight	14grm.

HEADMASTER MICROGROOVE CARTRIDGES (Yellow Spot): These are available in small quantities. Please book your order with your usual supplier to avoid disappointment. Price, 35/-.

THE CIRCUIT OF A RECOMMENDED PRE-AMPLIFIER WILL BE SUPPLIED with EACH CARTRIDGE

For Technical Information please write to Service Dept.

GOLDRING ENGINEERING (A/SIA) PTY. LTD., 57 H.E. AREA, ST. MARY'S, N.S.W.
Phone: St. Mary's 447 After Business Hours, UW6907

t ckness from 3-8-inch at the centre t ⅛-inch at tips.

Now using your knife or plane sape the aerfoil as per drawings. is is known as a semi-symmetrical ction, excellent for speed work, d just about useless for most other ms of model flying. Work carelly, finally using sandpaper to get nice, smooth wing with a close proximation of the aerfoil indited.

Now to fit the bell crank and wire ad-outs. This is the most difficult b in the whole plane, so pay plenty attention to the drawings.

Make two cut outs in the bottom lf of the wing as indicated by e broken lines. These are approxiately 1-8-inch by 1-8-inch along e span of the wing and are conderably enlarged at the centre, eing approximately 5-16-inch deep nd wide enough for free play of e bell crank.

INISHING

Lay thin aluminium tube (obtainble at model supply houses) in the rooves outboard of the fuselage, nd cement in place. Cement small ap strips in the remaining space nd, when dry, sand down level with ving under-surface. Your wing is ow complete and ready to be fitted o the fuselage.

Cement the wing firmly in place n the fuselage and remove any of he fuselage necessary to allow access o the bell crank or to secure free novement of same.

You can now add the cowling, which uses 1-32-inch plywood sides and hard balsa top. Be guided by he drawings and you should have no difficulty.

Make sure you use an opening n the front and the rear of the cowl as indicated, or your motor will become seriously overheated. Note the wire dowels—two at the front and one at the rear—which are used to locate the top of the fuselage correctly to the bottom half.

The tailplane is next and is very nearly self explanatory as regards fabrication. However, secure a good piece of 1-16-inch 3-ply and sand to a streamline section. Make sure of a good job on the elevator hinges, firmness without binding being very important here. Cement firmly in place and attach the push rod between the elevator horn and the wing mounted bell crank. Adjust the push rod so the elevator is neutral —neither up nor down—when the bell crank is square with the fuselage centre line.

ASSEMBLY

Having completed all the main parts it is now advisable to assemble the plane complete with engine, and check the alignment, as any alterations necessary will have to be done now before the paint job is done.

Check to see that the engine pulls straight ahead when viewed from both side and top view. Make sure that the wing and tailplane are both fitted with no incidence angle relative to the crutch line. Also check that tailplane, wings and cowling are square with one another when viewed from the front view.

Having satisfied yourself all is well, prepare for painting.

First give the entire plane two or three good coats of aircraft dope. When dry sand lightly and brush on two coats of Dulux Preparakote of the same color as your plane is to be when finished. When dry sand smooth and then brush on one full coat of Dulux. Allow three days to dry before attempting to run the engine.

If you have access to spray painting equipment, use it to secure an even better finish than is usually possible by hand painting.

Remember you must use a synthetic enamel finish, as a lacquer will strip under the action of methanol and the drying time I have suggested is just about a minimum even when using a good synthetic finish such as Dulux.

It is very important if the ultimate in speed is to be obtained that a good smooth automobile type of finish is obtained.

Now while your plane is drying get to work and carve yourself a whole batch of propellers, because the mortality rate on propellers is

(Continued on Page 83)

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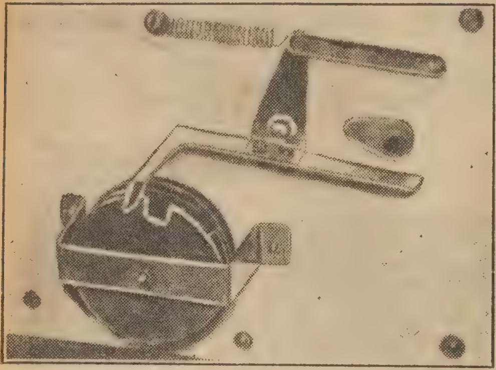
GOOD MONEY · INDEPENDENCE · TRAVEL

A DISC TYPE COMBINATION LOCK



A close-up view of the slotted discs and the pivotted locking arm. The mechanism can be quite light, since it merely controls the bolts. Strength of the lock is determined by the tongues and catches, although there is an obvious limit to the size of the latter which the mechanism can reliably control.

You can forget all about keys if you make up this combination lock for your private den or cupboard. If properly constructed, only those in the "know" will be able to open it, and you can change the settings any time. Apart from being an interesting and handy project, it has the advantage of requiring only everyday tools and materials.

COMBINATION locks have a peculiar fascination; their value for locking vaults, &c., has long been recognised and, though of a simplified construction, the one described here is far from easy to open when the combination is not known.

Four discs, each with 24 positions, are used. If the possible combinations total 24 x 24 x 24 x 24, equalling 331,776, then it would take months to try all the possibilities.

The lock can be made to screw on the inside of any door. As it only serves as an operating mechanism for the bolts the lock can be made from any thin metal. The resistance of the door to forcing will depend upon the strength of the bolts and their guides.

The door has a knob and combination dial (see Fig. 1a), which is secured to a spindle on which four slotted discs are free to rotate. Friction springs bear on the discs so that when the spindle is turned the discs remain motionless.

Each disc has projections so arranged that it can turn almost a complete revolution before striking the projection on the disc behind
thus turning the latter. The spine
has a finger which strikes the p
jecting pin on the first disc.

If the knob is turned several tin
in a clockwise direction the fing
will rotate the first disc, which w
turn until the second disc is a
brought into motion, and so on, un
all four discs are turning.

The dial is then stopped at
figure which will leave the slot
the rearmost disc upright. The kn
is then turned anti-clockwise un
first, second and third discs a
brought into motion, the knob bei
halted at a number which leaves t
third disc with its slot upright.

The knob is then turned clockwi
until the second disc is brought in
position, with its slot upward. An

clockwise rotation of the lock
made, one trial will show what num
bers must be turned to on the di
to bring the slots in the desire
positions.

The combination may then
written down as follows (for ex
ample), 4/17/3/1/2/23/1/9, whic
means: four turns clockwise, stop
17; three turns anti-clockwise, sto
at 1; two turns clockwise, stop
23; one turn anti-clockwise, stop at

If rotation is begun in an anti
clockwise direction the whole serie
of numbers will turn out differentl

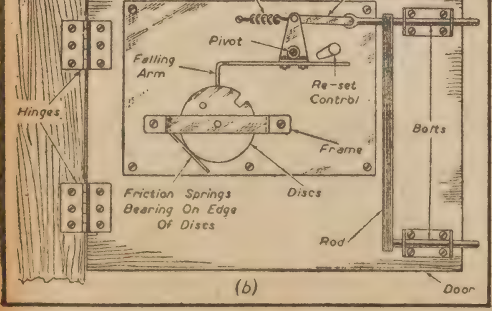

Door
Knob
Finger Secured To Axle
Flat Springs
Discs Free On Axle
Frame
(a)
Plate
Spring
Link
Pivot
Falling Arm
Re-set Control
Hinges
Frame
Bolts
Friction Springs Bearing On Edge Of Discs
Discs
Rod
(b)
Door

Figure 1. At the top, a plan view of the slotted discs. Below a side elevation of the completed lock. One or two bolts can be operated.

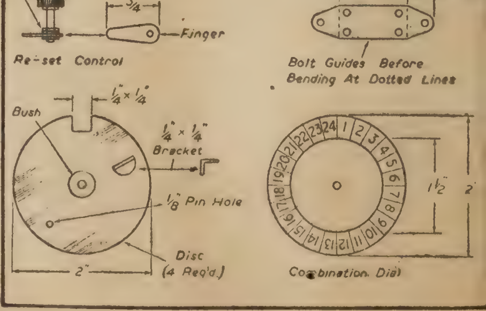

1/4"
1½"
1½"
1½"
Falling Arm
1½"
Pivot Bracket
1/4"
Lock Nuts
Small Knob
3/4"
Finger
Re-set Control
1"
3/8"
Bolt Guides Before Bending At Dotted Lines
Bush
1/4" x 1/4"
1/4" x 1/4" Bracket
1/8 Pin Hole
2"
Disc (4 Req'd.)
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1½"
2"
Combination Dial

Figure 2. Details of the various parts which make up the lock. Brackets and numbers are placed at random, the combination being determined later.

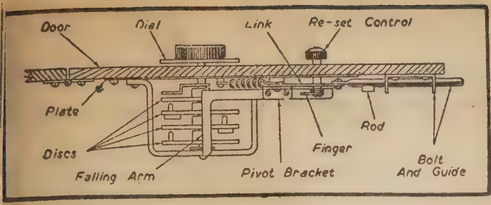


Figure 3. A plan view of the complete lock, showing the locking bolt and the knob for resetting the falling arm. Make sure of the combination before closing the door or it may take more patience than you have to discover the combination experimentally.

Actually, when the lock is made up, the sequence of operations will immediately become clear, and only a few seconds are required to open the door when the combination is known.

It is convenient to make up the lock on a metal plate about 4½ inches by 6 inches. This can then be screwed on the inside of the door. The lock mechanism is separate from the bolt or bolts holding the door shut: the latter will be fixed directly to the door and can be as robust as necessary.

Fig. 2 shows how the discs are cut. Sheet brass (20 SWG) is suitable, and bushes are soldered on so that the discs are free on the spindle without excessive wobble. The relationship between the pin hole, slot and bracket determines the combination, and these are best arranged at random.

Each bracket strikes the pin secured to the disc behind it. The pin on the first disc is struck by the finger soldered to the axle. No bracket is required on the fourth disc.

Fig. 1 shows how the axle and discs are arranged in a frame. Washers are added to prevent excessive looseness. A flat spring cut from brass bears lightly on each disc so that the discs only turn when they are carried round by their projections transmitting the motion from the finger.

RESET KNOB

As "B" in Fig. 1 shows, an arm is so arranged that a flange at one end falls into the slots. A spring helps this action, at the same time withdrawing the bolts through a connecting link.

The small knob (see Fig. 3) is only to re-set the lock. A small finger strikes the free end of the arm, thus raising the flange out of the slots and moving the bolts into position.

The combination dial is then turned at random and the lock is set. Before opening, turn this small knob so that the metal finger does not prevent the free end of the falling arm from rising.

The bolts should move smoothly and without undue friction, or the spring will have to be unnecessarily strong. In Fig. 1 two bolts joined by means of a rod are shown. For small boxes and cupboards a single bolt operated from the connecting link is sufficient.

The knob and combination dial should be soldered to the axle to avoid trouble, as if the combination is lost by the knob becoming loose it will be necessary to force open the door.

To obtain a smooth action the four discs should be accurately made and a washer-cutter will simplify this part of the work. A smear of grease should be applied to all the moving parts and to the edges of the discs.

The arm is not shown in Fig. 1a for clarity, but Fig. 3 illustrates its position.

B-CLASS CHAMPION TOPS 100 mph

(Continued from Page 81)

high until you get accustomed to speed flying. I have indicated a suitable propeller for use if you use the McCoy 29 engine, such as I have installed in my plane. I feel that this propeller will also give you top line results if used with the Eta 29 engine.

For top speed performance, use the McCoy 29, Dooling 29, or Eta 29 engines. The cowl dimensions given are for the McCoy 29, and slight alterations can be made to accommodate the other engines mentioned.

Well, there you are fellows—that's the story, that's the plane, and if you build it you won't be disappointed. Until next month, when I will tell you how to fly it. Cheerio.

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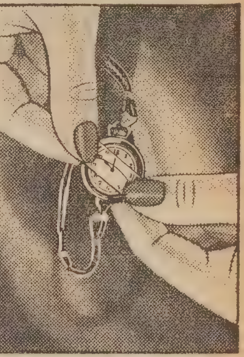

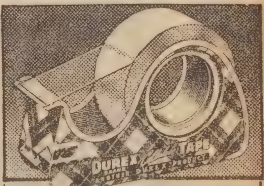

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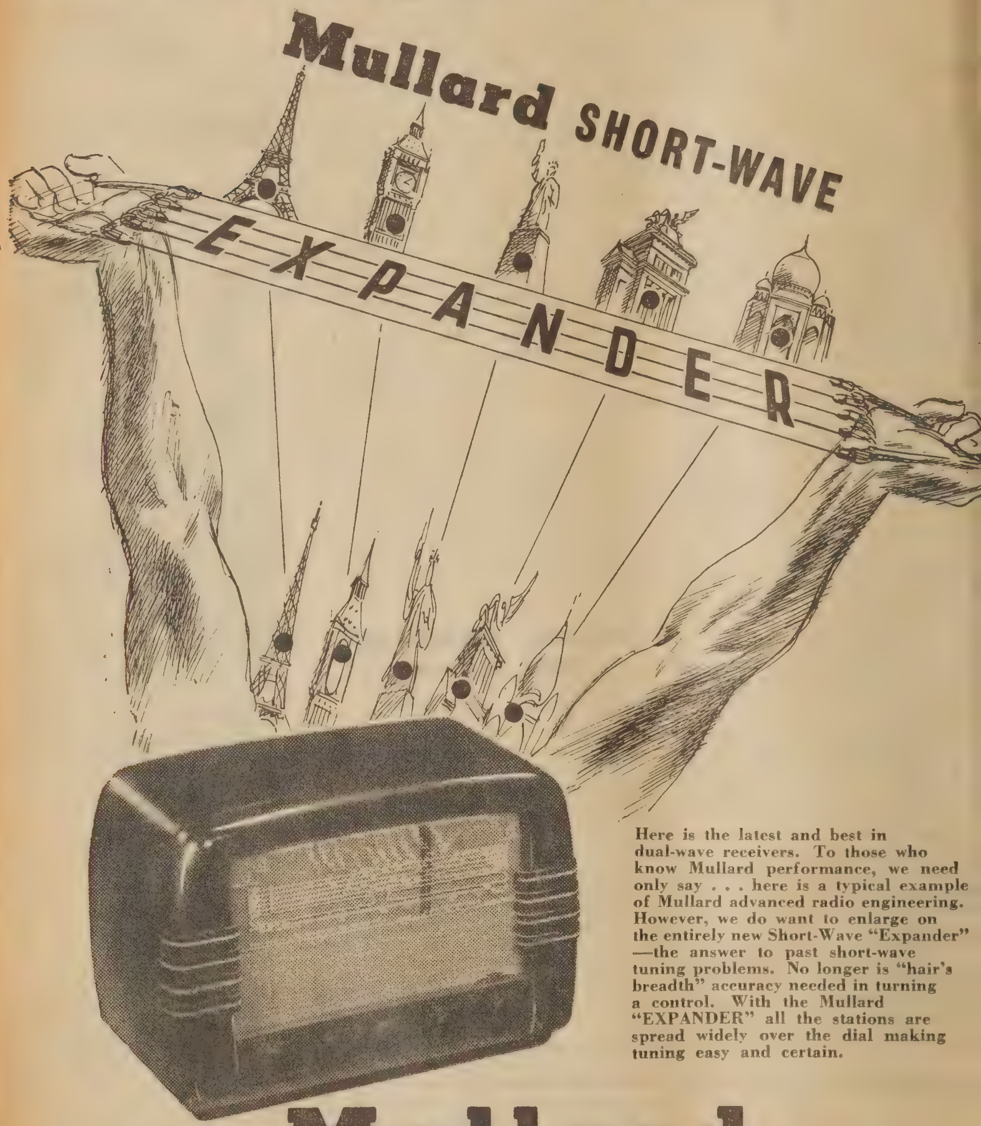

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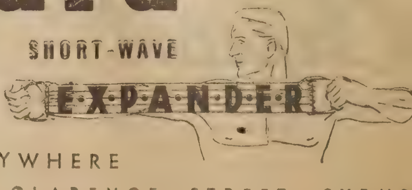

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HIGH FIDELITY RECEPTION

(Continued from Page 31)

ides but, because of the small uantities of (R), the pendulum ction continues on and over-rides e small high frequency variations, nd the result is a disproportionate coustic output. To raise the RF gain erely magnifies the disproportion nd the result sounds boomy. Lightly oaded loudspeakers produce a simiar effect from their piston-like ction, which tends to over-ride the esponse to high frequencies.

In a more critical case of transients t would be practically impossible o reproduce them because the pendulum action would continue after he extremely short pulse has ceased o exist. This latter feature is closely elated to the degree of noise produced by a receiver when affected by atmospherics. The tuned circuits xtend their time base and increase the noise.

TUNED CIRCUITS

It is common practice to employ the parallel resonant circuit which usually forms part of an interstage coupling transformer, and is designed to attain high selectivity. The high (Q) RF transformer merely complicates the matter.

The functions of each reactive component (L) and (C) are reversible, that is, they store energy and give out energy. The energy transferred from the primary to the secondary will. less losses due to (R), be handed back to the primary with a time lag and out of phase with oscillations in the primary.

This may be demonstrated mechanically by placing two chairs back to back and a foot or two apart. Fasten a piece of string from the top of one chair to the top of the other. From two selected points along the string suspend equal lengths of string with equal weights attached at their extremities.

Now swing one weight like a pendulum in a direction at right angles to the top string. Watch the transfer of motion from one pendulum to the other, as it is handed back from the second to the first pendulum again.

Returning to the parallel circuit, it is likely that amplifying-valve characteristics will be non-linear at reasonable amplitudes. Where there is non-linearity there is the possibility of rectification and intermodulation of the out-of-phase secondary-and-primary components.

The simple transformer is not the equivalent of an infinite line, nor can its (L) and (C) take the place of (R). The transformer should therefore be terminated in a resistance, but this would probably destroy the desired selectivity.

The words "look" and "see" are very useful terms to employ in radio. For example, if an aerial dipole were cut at the centre to enable a series resonant circuit to be connected between the two halves of the dipole, the dipole should "look" at the series resonant circuit but not "see" it. Alternatively, the series circuit should "look" as though it were not there. A transformer, however, should "see" its characteristic impedance at the termination, otherwise reflections may occur.

Hence the case of an aerial input preselector is bad enough, but here, fortunately, rectification does not normally occur, and circuit currents may freely oscillate simultaneously at many frequencies without intermodulation taking effect.

EFFECT OF "R"

The high (Q) parallel circuit has its valve outside the closed loop of the circuit, and, like the escapement and balance wheel analogy, the valve has little control over any subsequent pendulum action of the circuit. But, to add an effective damping factor (R) as a remedy, the sensitivity, selectivity and value of the receiver would be destroyed.

Many fidelity enthusiasts have built the TRF type of receiver and consider they have the answer to fidelity, but this may be a long way from the truth.

The fact that it is a TRF timer is not a standard of fidelity. It may be better than many others, but that is the most that can be said of it.

The foregoing should suffice to show that many factors are involved. Enthusiasts may well ask "what can be done about it?"

(To be continued.)

TRANSIENTS AND LOUDSPEAKER DAMPING

(Continued from Page 17).

being sufficient generally to obviate most of the oscillatory tendency. Further reductions in damping resistance improves the position but there is no practical point in going below about 10 or 20 per cent of the nominal impedance since the ultimate amount of damping possible and the maximum damping current is limited by the d-c resistance of the voice coil itself. Thus the contentions of group 3, referred to earlier are supported.

High flux density in the magnetic gap is desirable, since the current generated by the freely moving cone is increased and the damping is more effective for a given value of damping resistor. Figure 3 illustrates this point and shows the desirability, with an energised speaker, of keeping the field dissipation to its permissible limits.

Similarly, a permagnetic speaker with a large high flux magnet is fundamentally better equipped to handle transients than one with a less ambitious magnet structure.

As a side-issue, it is noteworthy that the voice coil impedance of most speakers increases considerably in the treble register, thereby limiting the driving current and acoustic output. It is thus conceivable that better apparent treble would be obtained from a high impedance source than one having very low impedance.

Since transient damping appears to be a vital issue, the only remedy is to design for a more constant voice coil impedance in the speaker or to use a discreet amount of treble pre-emphasis.

MAGNETIC IRON-OIL CLUTCHES

Magnetic-fluid clutches for automobiles and other types of applications have many advantages and also some weaknesses that must be overcome by further development, the American Institute of Electrical Engineers was told in New York by A. J. Parziale, Watertown Arsenal, NY, and P. D. Tilton, of Vickers, Inc., St. Louis.

The magnetic-fluid clutch is a development of the National Bureau of Standards, Washington, DC. It utilises oil containing iron powder. The preferred mixture is carbonyl iron powder in a light oil. The oil-iron mixture fills the gap between the faces of the clutch. When these faces are magnetised, the mixture "freezes" or solidifies when the iron particles cling together under the influence of the electric field. Power transmission is controlled by changing the magnetic field strength.

The advantages of a magnetic-fluid clutch for use in servo-mechanisms, Messrs. Parziale and Tilton stated, are its small size, simplicity, fast action, freedom from wear, smoothness, and a large ratio of output power to control signal power. Servo-mechanisms are devices used in the automatic control of many types of mechanisms, including some employed on airplanes.

The investigations of magnetic-fluid clutches reported at the meeting were made at the Massachusetts Institute of Technology, under the sponsorship of the US Air Force. Concern centred about servo-mechanisms rather than the ordinary automobile clutch.

The experimenters reported that the iron-oil mixture "must be able to withstand operation at temperatures as high as several hundred degrees Fahrenheit for long periods of time, and the fluid properties must prevent packing or settling of the iron powder into a dense, hard-packed mass during periods of storage or inactivity. This condition may be alleviated by the use of a wetting agent and a warm-up period of operation to stir the mixture." Other weaknesses were described, together with possible remedies.

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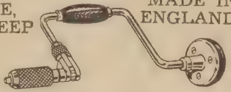

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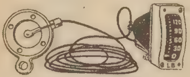

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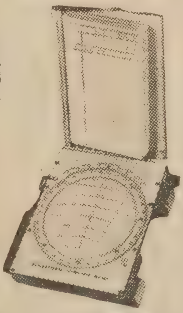

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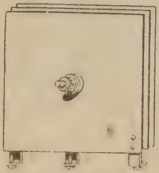

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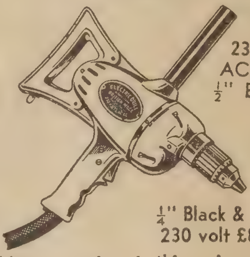

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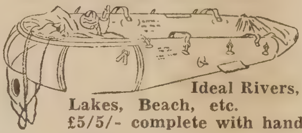

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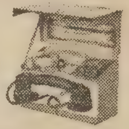

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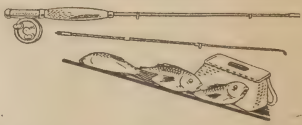

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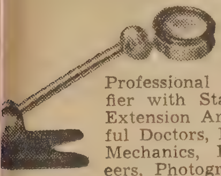

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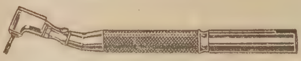

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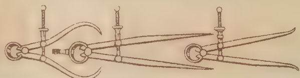

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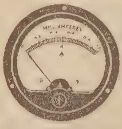

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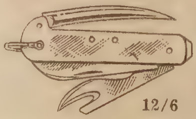

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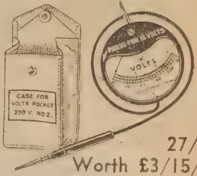
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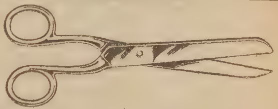

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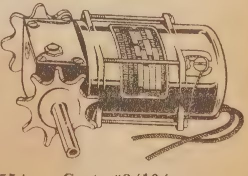

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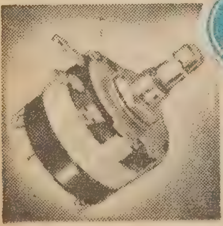

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COURSE IN TELEVISION

(Continued from Page 39.)

tube from registering faithfully nges in illumination level of the ginal subject. At the same time, timing pulses "float" with this ying reference level and fail to intain the strict peak value in pect to earth necessary to the ration of the pulses separators.

SIC REQUIREMENTS

here is no counterpart to all this audio amplification. The signals be amplified are fundamentally anced in character and may be arded at all times as sinoidal ves alternating around a mean ue.

While reference has been made to circuit only, the same remarks ly to all video systems. Once the ector has produced the required i-directional pulses, they must be thfully impressed as such on the ture tube grid. The simplest thod, of course, is to operate the ector at a high level and couple output direct to the picture tube, already outlined.

Such a plan is not always connient, however, and circumstances, ich need not be defined here, may tate the use of one or more vido plifier stages. To preserve faithly the d-c component would necesate direct coupling throughout the leo amplifier and complete stabiliion of the power supplies into the rgain. This is involved, to say the st, while failure of one valve or mponent in a direct coupled amfier may easily endanger other lves in the string.

C RESTORER

This, in turn, has produced the chnique of using resistance-capaance coupling in the video stages, ving reliability and wide frequency sponse but ignoring the d-c comnent from the detector. At the cture tube grid, however, a special rcuit is included which creates a w d-c component artificially and parts a uni-directional character the signal pulses. The circuit ich brings this about is known the "d-c restorer."

It is not proposed at this stage to ter into greater detail about d-c storer circuits, since the subject is sufficient importance to warrant special article a little later in the ries. However, the reader will now in a position to appreciate any ferences which may be made to e d-c component in further discusons of video and picture tube cirits.

Next month we plan to discuss e subject of video amplifiers which nplify the picture signals before plication to the tube. The emphas, as we shall see, is on providing in over an extremely wide range frequencies.

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SHORT WAVE NOTES BY RAY SIMPSON

BBC WANTS REPORTS FROM OVERSEAS LISTENERS

A recent issue of the BBC publication "London Calling," enclosed a very comprehensive reception report form. Short-wave listeners were asked to complete and return the forms addressed to Overseas Listeners Research, British Broadcasting Corporation, Broadcasting House, London, W.I.

IN addition to technical details of reception, they were also anxious to know which of the many services were listened to, such as Pacific, General Overseas, Far Eastern, &c. Other details requested are when the receiver is first turned on each day and when turned off: also which age group the listener is in.

The BBC has devised a system for reporting reception conditions based on the use of three figures from 0 to 5 which will show particulars of strength, interference, and the general value or overall merit of the broadcast. Here is the code to enable you to make out a report.

First figure	Strength
0	Inaudible
1	Very weak
2	Weak
3	Fairly strong
4	Strong
5	Very strong
Second figure	Interference
0	None
1	Very weak
2	Weak
3	Fairly strong
4	Strong
5	Very strong
Third figure	Merit
0	Nil; completely unintelligible
1	Very poor; only few words intelligible
2	Poor; but mainly intelligible
3	Fair; completely intelligible but close attention necessary
4	Good; completely intelligible and easy to follow
5	Very good; comparable with normal medium wave reception

Example: 514—very strong transmission, very weak interference, reception good, with programme completely intelligible and easy to follow.

Those listeners who would care to assist the BBC in this survey of their short-wave programmes should write to them and ask for a copy of this form. However, you could make up a fairly satisfactory report with the information given above plus details of your receiver, antenna and any other points which you think may be of interest.

CR5SA SAO THOME.—For some time now we have been trying to log either CR5SA on 11.785 mc or CR5SB on 9.615 mc, but unfortunately without success. However, we have now heard this station on an entirely different frequency, 4.81 mc. The best time to try for them is between 6.0 am and 7.0 am, though strength is very weak on most days. At 7.0 am they leave the air with announcement in Portuguese and give call letters which sounded like CR5SA.

The transmission is concluded with the playing of the well-known Portuguese National Anthem, A Portuguesa.

PORTUGESE CALLS

IT does not seem to be very long ago since the Portuguese stations changed their call letters, and now we have word via the Universalite of further changes. The new calls take the form of three letters followed by two numerals.

Emissora Nacional Lisbon 10 kw.

CSA38, 6360 kc; CSA21, 6374 kc; CSA22, 7260 kc; CSA23, 9635 kc; CSA24, 9670 kc; CSA25, 9680 kc; CSA26, 9727 kc; CSA27, 9740 kc; CSA28, 9940 kc; CSA29, 11027 kc; CSA30, 11,040 kc; CSA31, 11,840 kc; CSA32, 11,995 kc; CSA33, 12,749 kc; CSA39, 15,100 kc; CSA35, 15,110 kc; CSA36, 15,120 kc; CSA34, 15,160 kc; CSA37, 15,320 kc.

Private Stations

CSB53, 3960 kc, 10 kw, Lisbon; CSB56, 6003 kc, 200 watts, Lisbon; CSB52, 6154 kc, 2kw, Lisbon; CSB54, 6185 kc, 350 watts, Lisbon; CSB55, 9650 kc, 2 kw, Lisbon; CSB57, 12,130 kc, 2kw, Lisbon; CSB51, 12,865 kc, 500 watts, Parede.

Ponta Delgado, Azores, 1 kw.

CSA93, 4845 kc; CSA91, 7018 kc; CSA92, 11,090 kc.

It is interesting to note that Emissora Nacional now lists 15,100 kc, 15,110 kc, 15,120 kc, 15,160 kc, and 15,320 kc, but do not make any mention of their 15,145 kc channel, which they were using only a few months ago.

LATIN-AMERICAN STATIONS

IN last month's issue we covered majority of these interesting stat which are now being heard in Austr This month we will list a few more wh have been reported to us as being log in New Zealand. While a large num of these stations will normally be audible in Australia due mainly to time difference between Australia New Zealand, it is quite possible that a favorable day they could be logged here.

The Colombian station HJKD on 6. comes in well till closing at 3.0 pm a programme sponsored by Camel cig ettes. OAX6B which is known as Ra Landa and is located in Arequipa, Pe operates on 6.038mc and also closes 3.0 pm.

A short time ago a New Zealand liste heard a test transmission from the H duras station HROW which was th using 5.9mc from around 6.0 pm. T station is located in Tegucigalpa. Anot Honduras station, HRA, known as "Voz Lampira" has been logged in the ea afternoon operating on 5.92mc. T station is also supposed to be operat on 9.035mc at the same time, but we h had no reports of anyone hearing Another station in the 49 metre b which has been heard of late is CX in Montevideo, Uruguay, which transm on 6.055mc and was logged at 2.0 pm at only fair strength. The name of station is Difusora MGA Ministerio Granaderiay Agricultura Montevideo it operates with a power of 10kw.

OTHER CALL SIGNS

There is another Peruvian, OA which can be heard on 6.33mc till a 2.0 pm on Sundays when it is relay OAX4W and OAX4V. Two Nicarag stations have also been logged, the being YNOW "Voz de America Cent on 6.85mc and the second, YNEQ "La de Vittoria" on 6.95mc. Incidentally latter station is coming in very well Sydney from around 10.0 pm. Moving f Nicaragua down to Ecuador there HC4EB in Manta heard on 6.87mc noon and HC2AM "Radiodifusora Ce in Guayaquil which uses 7.35mc. Acc ing to our latest short wave list th are 40 stations listed for Colombia possibly a few of them are inact However, there are quite a few he heard, amongst them HJFA in Per on 4.865mc, HJDE in Medellin on 6.145 HJEX on 6.055mc and located in C Other Colombians which have b logged at various times are HJCF "Or Bogotonas" on 6.24mc, HJCQ Ra Nacional on 11.68mc and HJKJ wh uses 6.16mc.

Quite a number of Brazilians are audible both in N.Z. and in Austr the best of these being PRL7 on 9.72 and PRL8 on 11.72mc. Others howe are ZYB7 on 6.095mc at 7.0 am. Z on 11.765mc around 11.0 am and Z on 15.155mc also at 7.0 am. ZYC8 "Ra Tamoya" 9.61mc is another morn station while if you move up to the metre band a good morning will you PRJ4 on 4.825mc, this station be located in Paranahyba and operated the Department of Education.

VERIFICATIONS RECENTLY RECEIVED

4VRW HAITI.—This station, which used to be known as HH3W, had a very bad reputation as regards verifications, as despite many letters verifications never arrived. However, this situation has improved considerably, and according to their card just received they seem to appreciate reports from listeners. Their card is printed in English and gives full verification details together with information about the station. They now operate on 10.205 mc with a power of 1400 watts and are on the air from 9.0 pm daily. The station director is C. Ricardo Widmaier and their address PO Box A117, Port-au-Prince, Haiti. At the bottom of the card they [illegible] you to "drink Haitian coffee, the best in the world."

HC2FQ ECUADOR. — Another of the Latin Americans has recently sent along their verification card, this one being HC2FQ, Guayaquil, Ecuador, which operates on [illegible]. Actually they sent two [illegible], one a [illegible] one giving their slogan, Radio Continental, together with call letters, while the other gives verification information and is signed by the manager, Gabriel Tramontana. On this card they give their title as La Voz del Tropico Ecuatoriano and also display a globe and microphone surrounded by clouds. It is interesting to note that they have two other short-wave outlets, HC2FW on 12.805 mc and HC2FX on 15.15 mc, in addition to their broadcast band station HC2FL on 1400 kc.

V3USE MAURITIUS.—We use the above call letters for this station as they seem to be generally accepted in overseas radio magazines, but there is no mention of any call on the station verification, the only title being Mauritius Broadcasting Station. Their verification consists of an ordinary air letter with printed details inside. They show frequencies as 1364 kc and 15.075 mc, with power of 5 kw for the first and 1.5 kw for the short-wave channel. Their transmission times in English and French are given as 1.0 pm to 2.15 pm, 6.0 pm to 7.30 pm, and 12.30 am to 3.0 am. Their air letter is signed by the station manager, Mr. Chapel, and the address is merely Forest Side, Mauritius.

LASHES FROM EVERYWHERE

UDI-ARABIA.—We learn from S den Calling DX-ers that the pro- nmes from Saudi Arabia are for the ent only being transmitted from Djed- but in the future the main part of programme will be compiled in ka. This information was received ct from the station by a Swedish ner, and stated that the frequencies use were 3.96 mc, 5.985 mc, 9.645 mc, mc, and 11.95 mc, also an additional in the medium wave band. Their out is 3 kw, and they are said to be the air daily from 3.0 am to 4.30 am, have also been reported as being rd from 3.30 pm to 4.0 pm. A few ths ago Art Cushen heard this station quite good level.

ERSIA.—From the same source it is ed that Radio Teheran is using EQB 6.155 mc for their morning and even- programmes, while their evening sion is also transmitted over EQC on mc and EPB on 15.1 mc. The time the latter programme is said to be 4.30 to 6.30 am, though we have also heard B at quite fair strength around 9.30 This station has two other outlets ich do not seem to be in use at pre- t, these being EPF on 8.11 mc and EQD 4.78 mc. This country also has two er stations at least, Radio Azerbaijan, ich is assigned to 6.09 mc and 11.98 No difficulty should be experiencd logging EQB if you care to listen around am to 4.0 am.

SHORT-WAVE Notes for the August issue are due on July 8. For the September issue they are due on August 5. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.

MALTA.—From various sources we arn that the Forces Broadcasting station Malta soon hopes to begin testing a new ansmitter, which will use the 13 metre nd in the day time, and the 25 metre nd at night. This new transmitter will beamed to East Africa. Their present hedule is 2.0 pm to 5.0 pm, on 4.965 mc, d also on the same outlet from 11.30 pm 7.0 am. On 7.27 mc, they operate from pm to 5.0 pm, and from 7.30 pm to 1.15 n. Their 25 metre band outlet on 895 mc, is in use from 7.30 pm to 1.15 n, and is quite good at our location on osing. The station is still making tests determine the most satisfactory fre- ency for the period 1.30 am to 7.0 am.

DENMARK.—This item is really of a ilatelic interest, but as it is connected th radio we are mentioning it as we ow it will be of interest to some of r readers. The Danish Post Office has cently issued a postage stamp evidently commemorate the 25th anniversary of e founding of the State Radio. The amp we have seen is the 20 ore value, th a view of radio masts and the in- ription Statsradiofonien 1925—1950. A ry nice tie-up in this regard would be receive a verification card from Den- ark franked with one of these com- emoration stamps as it would indeed a novelty.

SUEZ CANAL ZONE.—From the same blication we note that it is reported at th Forces Broadcasting Station at yid has been heard recently. It was gged on 7.22 mc, transmitting a test pro- amme from 5 0 pm till 5.30 pm, and an- uncing as "This is your Forces Broad- sting Service, Fayid," or "This is your rces Broadcasting Service, Middle East, lling from Fayid." Another listener ports having heard this station from 6.0 to 6.30 pm. In our last word from e headquarters of the Forcs Broadcast- Service in Malta, they made no com- ent regarding a short wave outlet from yid, but only listed them as broadcast- on medium wave. However, it is orth while keeping a watch for them.

NEW STATION LOGGINGS

Call	Kc	Metres	Location	Time Heard
Johannesburg	3356	89.45	Johannesburg, South Africa	4.00 am
CR5SA	4810	62.37	Sao. Thome Island	6.30 am
ZEAF	4885	61.41	Salisbury, S. Rhodesia	4.00 am
HC2FB	6130	48.94	Guayaquil, Equador	4.00 pm
Munich	6140	48.86	Munich, Germany	7.00 am
Johannesburg	7295	41.12	Johannesburg, South Africa	1.00 am
WABC	15130	19.83	New York, N.Y., U.S.A.	6.45 am
Tangier	15210	19.72	Tangier, North Afrcia	6.30 am
WBOS	15285	19.63	Boston, Mass, U.S.A.	7.30 am
Rome	15315	19.60	Rome, Italy	11.0 am

HAVE YOU HEARD THESE STATIONS?

ITALY.—In last month's issue we mentioned hearing Radio Italiana transmitting on a new frequency in the 25 metre band, 11.9 mc and since that time we have heard them experimenting on still another channel, this time, 15.315 mc. The 19 metre is not very good till nearly 7.0 am, but by that time you can clearly hear Rome with the same programme as on 9.63 mc and 11.81 mc. Before the war, Rome was using 15.3 mc under the call letters 2RO6, but this new transmission is definitely on 15.315 mc. It should be worth while watching some of the other bands to see if they make any further changes, as they are evidently in search of other outlets.

USA.—The only new outlets from the USA this month are WABC on 15.13 mc, which can be heard around 6.30 am, and WBOS, also in the 19 metre band, on 15.285 mc, around the same time. We have an idea there are a few other changes in the sessions heard here in the very early hours, but strength has been too weak to positively identify the call letters. We have recently heard that the majority of the USA Voice of America stations are all to operate under the one call sign, WABC, but we have no confirmation of this at time of writing. The Armed Forces Radio Service stations we understand are still to use the call signs of the particular stations being used.

SOUTH AFRICA.—We have already mentioned the commercial programmes to be broadcast by the South African Broadcasting Corporation under the title of Springbok Radio. By a recent mail we have received the current schedule from this organisation and note that these programmes took the air as from May 1, 1950, and are as follows: Johannesburg, 3.356 mc, 2.45 pm to 4.45 pm, weekdays and Saturdays; 1.15 am to 7.3 am daily (Sundays to 8.3 am); 1.30 am to 7.3 am, Mondays. Johannesburg, 7.295 mc, 5.0 pm to 1.0 am weekdays; 4.0 pm Sundays to 1.15 am, Monday. At the time of writing we have heard both these stations, but not at sufficient strength to obtain sufficient material for a report.

The best time to listen for the 7.295 mc outlet is from around 12.30 am till it leaves the air at 1.0 am. Unforuntely, this new station is on practically the same frequency as YD13 Soerabaja, and unless your receiver is extremely selective you will have no hope of separating them. Actually, it is about 2 kc lower than YD13, and can just be heard till carrier is switched off at 1.0 am. If they stayed on the air until after YD13 closed, they could possibly be copied quite all right. The 3.356 mc channel is also very weak, though there is no interference. Unlike some of the other African stations, it loses strength after 5.0 am, and is quite inaudible at 6.0 am. Perhaps on a particularly good morning it may be heard at better level.

GERMANY.—The European section of the Voice of America relay have recently opened up another transmitter in Munich operating on 6.14 mc, and it can be heard at quite good strength from 6.30 am, and possibly much earlier as well. It seems to carry the same programme as on 6.08 mc, when we have heard it, but may not always do so. The Mitteldeutscher Rundfunk station in Leipzig has recently been heard on approximately 10,515 mc. This would seem to be a parasitic frequency, being 9.73 mc, plus their broadcast band outlet on 785 kc. When heard on 10.515 mc, they have been equally as loud as on 9.73 mc.

TANGIER.—Here is another of the Voice of America transmitters which seems to be having difficulty in finding a suitable outlet, as we now notice they are operating on 15.21 mc instead of 15.25 mc. On some mornings at 7.0 am, they are particularly good, while on others they are barely audible, which is probably due to seasonal change affecting this band. Actually the loudest signal we have ever heard from this station was when they were operating on 7.22 mc. Without a doubt this was the finest signal we have ever heard from any African. Watch out for them in the 16 and 13 metre bands, as they may also show up there.

SOUTHERN RHODESIA.—The Government station in Salisbury, Southern Rhodesia, is apparently another station which is still conducting tests to find the most suitable frequency, as we have recently heard them on 4.885 mc. At 4.0 am, they give the BBC news, and then at 4.15 am, the weather report is read, followed by local news. This was followed in turn by a half-hour variety programme. Strength was nearly equal to Mozambique on the same band, and definitely much better than when they were using 3.32 mc a few months ago. On the hour and half-hour a lady announces, "This is Southern Rhodesia calling from Salisbury."

SOME ADDRESSES

TIRANA. Direction Centrale de la Radiodiffusion d'Albanie, Rue Conference de Peza 3, Tirania, Albania.

ANDORRA. Emisiones de Radio Andorra, Roc de les Anelletes, Andorra la Vieja, Principada de Andorra.

ORK. Institut National Belge de Radiodiffusion, Place Eugene Flagey 18, Brussels, Belgium.

SOFIA. Direction de la Radiodiffusion Sofia, Sofia, Bulgaria.

THA. Radio Algerie, 10. Rue Hoche, Algiers, Algeria.

CR6RB. Radio Club de Benguela, P.O. Box 19, Benguela, Angola.

CSA91. Emissora Regional dos Acores, Ponta Delgado, San Miguel, Azores.

CR4AA. Radio Club de Cabo Verde, Service de Fezenda, Praia, Cap Verde Islands.

DAMASCUS. The Syrian Broadcasting Station, Jamal Pasha Street, Damascus, Syria.

RANGOON. Burma Broadcasting Service, 28 Windermere Crescent, Rangoon, Burma.

HS8PD. Overseas Broadcasting Station, Publicity Department, Bangkok, Siam.

ZL3. New Zealand Broadcasting Service, P.O. Box 3045, Wellington, New Zealand.

DZH6. Far East Broadcasting Co., Box 2041, Manila, Philippines.

DZH3. Philippine Broadcasting Corporation, Ramon Roces Building, Manila, Philippines.

CHOL. Canadian Broadcasting Corporation, P.O. Box 7000, Montreal, Canada.

CBFW. Canadian Broadcasting Corporation, 1231 St. Catherine Street West, Montreal, Que., Canada.

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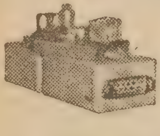

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Radio and Hobbies Car Radio Kit, as described in May, 1949, issue of Radio and Hobbies. Homecrafts offer this kit, complete to the last nut and bolt. Price, as illustrated. 18 Gns. Including Sales Tax.

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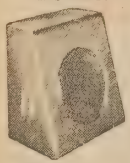
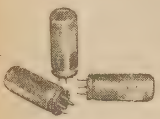


As illusrated, with brown crackle finish. Suitable for up to 8in. speaker. Price, as illustrated 28/6.



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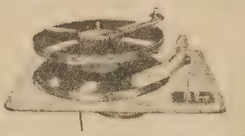
Suitable to replace all Collaro or Garrard magnetic pickups. When ordering, advise if required for Garrard or Collaro pickups.
Price, 45/-.



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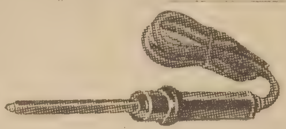

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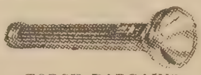

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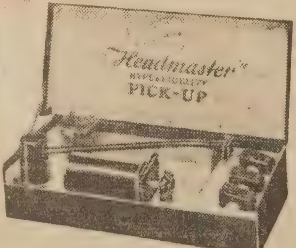

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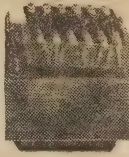

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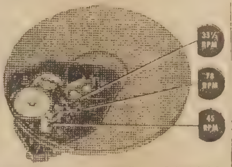

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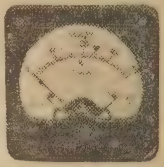

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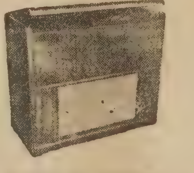

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HE HAM BANDS WITH BILL MOORE

**uring the last two years, radio amateurs throughout Australia have been called upon many
mes to effect communication for the authorities when other channels failed. Amateurs
ave become very "emergency conscious" and when the Macquarie and Lachlan Rivers
flooded during April they were standing by ready to render assistance.**

IATEURS in the Forbes and Dubbo
districts were also active in the
rgency.
the Forbes area, stations were oper-
g from April 4th to the 11th assisting
police, army and other authorities.
me of the operators were continuously
vatch for 16 hours handling messages
erning food supplies, rescue work,
generally assisting to alleviate distress
ne area.

the evening of April 3, Army
cks" arrived in Forbes. The town itself
cut into three by the floodwaters and
in a serious plight. On the following
ning Bill VK2BT phoned Hugh Stitt
WH to say the Army had set up a
rol station at the Town Hall for con-
ing HQ and communicating with the
cks," but was having difficulty in
ing contact with HQ and could he
st?

K2WH was the only station in the
operating on 3.5mc. He then opened
mc contacting official station VK2AA
esting permission to operate on 3830
the Army frequency, and assist in
cting a link between Forbes and HQ
s permission was forthcoming and
WH's main transmitter was shifted to
frequency and remained there for
eriod of seven days.

ommunication could at all times be
le with Army HQ and the station was
d as an intermediate link between
and the control station and the
icks." It was also used to communicate
ect with the "Ducks" when they were
rating 70 miles out of Forbes in the
dobolin area.

t this point it might be mentioned
t some difficulty was experienced in
ring the "Ducks" when they moved
a little. The "Ducks" were using a
tical whip antenna and the normal
enna at VK2WH is a ½ wave hori-
tal dipole. On changing to a vertical
enna the signals from the "Ducks"
greatly, so for the rest of the work
antennae were in use, one to the
icks," the other to HQ.

O CHANNELS

he 3.8mc frequency proved not very
ective around 1130 hours, signal
engths dropping off considerably, and
would appear that all amateur emer-
cy equipment should cover both the
nd 3.5mc bands.

ther stations in the Forbes area who
e active in the emergency work in-
ded Bill Kennedy VK2BT and John
rr VK2AMV. They were active on both
mc and 7mc, besides having a 50mc
between all three stations, VK2WH,
and 2AMV. They were also in com-
nication with VK2AA handling PMG
ffic on the official emergency fre-
ncy, of 7002 kcs. Practically all the
rgency work was conducted on tele-
ny as the Army was using this method
communication. VK2AA official station
tinuously monitored 7002 kcs and
e the amateur stations operating
ry assistance.

arly in the operation considerable
uble was experienced from New Zea-
d stations operating during the even-
s. Their 3.5mc band extends to 4mc.
this point Trevor Evans VK2NS com-
nicated with a New Zealand station
the 14mc band, who passed on a
uest to the other ZL's to clear the
quency of 3830 kcs for emergency
rking. In a brief period the frequency
s cleared and on the following evening
3JT NZ official monitoring station
ne up on 3830 kcs and announced he
uld be standing by and acting as
rd station until the operation finished
uite a number of the local population
re listening on the emergency frequencies and in one case, where a message for the feeding of some stock was concerned, the stock were fed before the message was officially received. BC1 for once was forgiven while the locals followed the course of events.

Later in the period "Ducks" moved into the Warren area and a "CQ Dubbo" on 7mc from VK2WH raised Bob Bensley, VK2XP, who was requested to look out for them. Bob stated, however, that he had been "mothering" them for the previous two days.

All stations were fortunately able to operate their main home stations, VK2WH however used a battery operated No. 11 for his work on the 7mc band. During the later portion of the operation VK2WH, 2BT and 2AMV worked shifts on the Army frequency of 3830 kcs.

Local authorities co-operated fully with the amateur stations and at one stage, after a request by VK2BT, the power and light people worked through the night to effect repairs so that power would be available to VK2WH's main transmitter.

Many other stations outside the flooded areas assisted in keeping channels clear and calling up other districts. Mention could be made of VK2GS and VK2WI operated by VK2VW besides VK2AMR and many others.

The wives of the various amateurs concerned should also be complimented, as they had to put up with quite a deal for seven days. Mrs. Marr, wife of VK2AMV, for instance, monitored 3830 kcs for a number of days calling John as he was required. After the normal business of the town suspended he was of course available full time.

Approximately 400 messages were handled by amateur stations during the emergency and again it was clearly shown how radio amateurs fit into the communications side of these unfortunate disasters.

Going back to last year's Kempsey floods, it was pleasing to see Chas Pedde, VK2KN and his assistant receive a certificate from the NSW Police authorities for the work they performed during the emergency. The certificates were officially presented at the June meeting of the NSW Division of the W.I.A.

INSTITUTE ACTIVITIES

OFFICIAL positions in the NSW division of the WIA were announced after the initial council meeting. The offices and their occupiers are as follows:—State President, Jim Corbin, VK2YC. Vice-Presidents, Vaughan Wilson, VK2VW and Wal Nye, VK2XU. Secretary, Maurice Butler, VK2AAN and Assistant Secretary and Acting Treasurer, Dave Evans, VK2AYE. The disposals committee comprises Fred Phillips, VK2ZQ as chairman and members Wal Nye, VK2XU and Maurice Butler, VK2AAN. VHF Liaison and publicity officer, Vaughan Wilson, VK2VW, AOCP class manager, Allan Appleby, VK2BF. contest committee — Ray Priddle, VK2RA. Dave Duff, VK2EO and Bill Macgowan, VK2MO, QSL officer. Jim Corbin, VK2YC, country Liaison and emergency co-ordinator, Bill Moore, VK2HZ, librarian, Dick Dowe, VK2RP, traffic manager, Roy Egan, VK2ARE, and bulletin dispatch officer, Pete Vesper, VK2PV. The constitution committee consists of John Moyle, VK2JU, Morrie Meyers, VK2VN, Brian Anderson, VK2AND and Fred Carruthers, VK2PF.

All country zone officers were re-elected for the ensuing year, they comprise: Crieff Rettalick, VK2XO. North Coast, Harold Whyte, VK2AHA, Newcastle, Harry Hawkins, VK2YL, Coalfields, Hugh Stiff VK2WH, Western and Roy Reyner, VK2DO, South Coast and Southern. Several other positions have yet to be filled. The growth of the WIA in NSW since the war necessitates the appointment of so many officers—membership has increased threefold. The total membership of the WIA throughout Australia is 2262, comprising 1600 licenced amateurs about 70 per cent of the active amateurs in the commonwealth.

The annual meeting of the NSW WIH UHF section saw Ray Hancock, VK2YM elected president of the section, Fred Stirk, VK2ABC, vice-president and Cess Cronin secretary. This section meets on the second Friday of each month at Science House, Sydney, and UHF enthusiasts are very welcome.

The Federal Executive will run during the next UHF season (summer 1950-51) The trophy for the transmitting section will be known as "The Ross H. Hull Memorial Trophy."

The rules will approximate those used during the summer UHF contest run by the NSW division.

Applicants for the "CQ" Magazine's DX WAZ award will be interested to learn that UAOKAA on Dicson Island is not located in zone 17, but in zone 18. WAZ maps indicate that this Russian station is in the former zone but the official ruling is that no UAO stations are in zone 17. Stations under the following prefixes UH8, UI8, UJ8, UL8 and some of the UA9's are in Z.17 included amongst the latter are UA9CC, 9DP and 9CQ or any Sverdlovsk stations. UA9's are either in zone 16, 17 or 18, while UAO's are either in 18 or 19, but never in Z.17.

NZART awards manager, Jock White, ZL2GX wishes to point out, that although some of the WAP (worked all Pacific) lists shows Malaya, VS1/2, it is not an eligible country for the award as it is located in Asia. Only suitable countries are those marked O in the CQ countries list that means, they are located in the Oceania Continental area. Jock also points out that, international reply coupons are only redeemable in New Zealand at a large discount, and suggests that applicants for awards should send either postage stamps, or Empire reply coupons.

DX AND PERSONAL

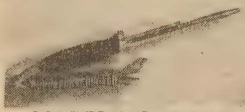
THE Africans have apparently been granted the use of the 21mc band as a number have been heard and some worked cross-band to 28mc. Peter Alexander, VK2PA reported ZE2KH, RS—58 in a 21/28mc cross-band contact.

The Europeans are certainly getting around on the 144mc band. PAOPN in a claim for a DXCC, included cards from G2ADZ, F8OL, DL3FM and PAOCB for 144mc contacts.

The conospheric prediction charts covering the amateur bands and published monthly in "Amateur Radio," still tell a sorry story to the DX man. The 14 and 28mc bands have been comparatively useless for many months now. The sunspot maximum has passed and the next couple of years should see a gradual improvement in conditions on these bands. The sunspot minimum is listed for 1954-5 and the DX will really come into its own again.

Hugh Stitt, VK2WH reports that Germans using DK8 and DK9 prefixes are located in occupied zones where amateur transmissions are theoretically not permitted. The DK8's are in the Russian zone and DK9's in the French zone QSL cards will be accepted via the DARC.

RADIO SPECIALS



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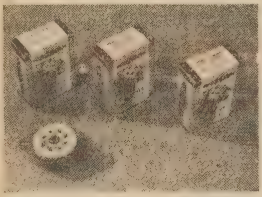

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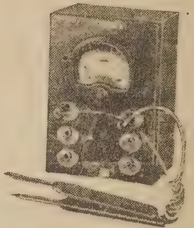

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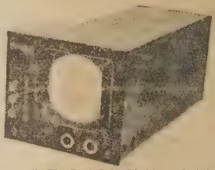

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This unit can be converted to an oscilloscope or stripped for the parts, Valves, etc. Parts are:—

1—5 B.P.1 Valve, complete with socket and Mu Metal shield.
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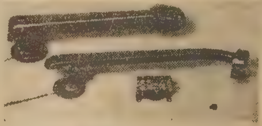

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Overseas News and Comment

ROPEANS and Americans are fu enjoying the present excellent cond. s prevailing on the 160 metre band ty of contacts are being made across e Pond" and English stations using its as low as ten watts have been essfully working the Americans.

ations using the following prefixes active GD, GM, G, GW, FA8, E1, DL, and PY, while Ken Ellis, HZIKE and k Spenceley, KV4AA supplying the sual.

ery many W and VE stations of course, active, too. Australian amateurs have been allowed to operate on this band e the war, and it was really little used e, except during contests in the pre- period.

he main problem of course being the ount of static experienced during the ater part of the year. BC1 in America o problem as it is the repsonsibility of listener to rectify it, if the receiver not of modern design; how the English ateurs manage to keep it under control nother matter.

WV and WWVH standard frequency nsmissions have been revised and the owing schedules now operate.

/WV—standard radio frequencies of 2 10, 15, 20, 25, 30 and 35 mc/s are iated continuously. Time announcements are made at 5 minute intervals by ce and International Morse Code. ndard time intervals of 1 second, 1, 4 1 5 minutes are transmitted, plus standl audio frequency tones of 440 and 600 les. Radio propagation disturbance rnings are also supplied using the code for warning, U for unstable conditions d N for normal.

The audio frequencies are interrupted ecisely one minute before the hour and e resumed precisely on the hour and ch five minutes afterwards. The 600 cle tone starts on the hour and each n minutes afterwards, continuing for 4 nutes; the 400 cycle tone commencing e minutes after the hour and each ten nutes afterwards. It also continues for ur minutes in each period. Each carrier modulated by a second pulse heard a faint tick. The pulse at the beginning the last second in each minute is nitted.

WWVH, located in Hawaii, is heard excellent strength in Australia and erates on an experimental basis on 5, and 15 mc/s.

TVI is certainly receiving plenty of blicity overseas, but judging from rrent comment the problem is slowly ing overcome by filters and screening. The Radio Society of Great Britain has mmenced a drive to see that amateur dio experimenters receive the fullest presentation possible at the forthcoming ternational Tele-communications Conference to be held at Buenos Aires in 952.

The Swedish National Amateur Radio Society recently held celebrations to commerorate their 25th anniversay and at this convention the RSGB proposed that a Scandinavian amateur representative travel to Buenos Aires.

When not attached to their own national delegatiion, representatives of amateur radio bodies attend as accredited delegates of the IARU (International Amateur Radio Union). At Atlantic City, there were two such accredited delegates. S. K. Lewer G6LJ and J. Clarricoats, G6CL, president and secretary respectively of the RSGB. It is hoped that many more will be in attendance at Buenos Aires.

Some additional news of the 160 meter band from overseas is to hand. Ken Ellis, HZIKE has been working through to England on this band, and has also heard WWV's signals on 2.5mc at S3. Of interest is the fact that W2WFZ is using a three element beam on 160 metres directed on Europe. Supported by weather balloons and with 260 feet of wire per element he has been putting RST589 signals into England during peak conditions.

Further news of the future of the 21mc band should be to hand after September 1, as on that date an administrative conference will be held in Geneva to discuss the new world-wide station list for frequencies below 30 mc/s. This list has been prepared by the Provisional Frequency Board which was set up after the Atlantic City I.T.U. meeting. They have been working on the list since 1948.

WIA MEMBERSHIP

NTENDING members of the Wireless Institute of Australia can obtain membership application forms from the visional secretaries listed below. Full embership is available to all licensed dio amateurs and holders of equivalent alifications, while associate memberip is available to those interested in e hobby.

New South Wales:— M. Butler, K2AAN, Box 1734, G. P. O., Sydney.

Victoria:—C. Dyer, VK3DY, 191 Queen reet, Melbourne, C1.

Queensland:— W. L. Evans, VK4TB, ox 638J, G.P.O., Brisbane.

South Australia:—Hon. Secretary, Box 34K, G. P. O., Adelaide.

Western Australia:—W. E. Coxon, K6AG, 7 Howard Street, Perth.

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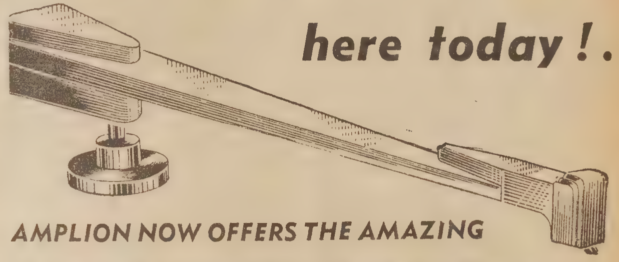

AMPLION NOW OFFERS THE AMAZING

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OFF THE RECORD — NEWS & REVIEWS

Most interesting news of the month is a report from England that the Decca company has released microgroove records in England. Judging from the opinions expressed by record collectors in that country, the move will be greeted with great enthusiasm.

By JOHN MOYLE

EVER since the big noise began over the new record speeds in America, the rest of the record world has been watching with the keenest possible interest to see what public reaction would be, and which of the various possible roads it would be most profitable to follow.

As most enthusiasts know, the RCA and Columbia companies in USA, have been waging intensive war for some time now to establish better standard for records, something that will give all the best points of the 78 rpm records plus quieter surfaces and longer playing.

Columbia were first in the field with discs pressed on vinylite, running at a speed of 33 1-3 rpm, and with fine grooves. The largest of these discs ran long enough to include the whole movement of a symphony, and sometimes more, on a single side, with 20 minutes or so uninterrupted playing.

The effect on the market was terrific, so much so, that RCA considered it essential to do something about it very quickly. They came out with a neat little automatic record changer which played discs running at 45 rpm, much smaller than the present types. But they lacked one feature—the long playing capabilities equal to those of Columbia.

After months of wrangling, conferences and walk-outs, the positio now seems resolved in a clear-cu win for the 33 1-3 record. No doub the RCA changers will continue to b produced, and records issued fo them. They seem fated, however, t become a useful little home juke box, capable of turning out ja records for long periods, with break of only three seconds betwee each for the changer to operate. doubt whether we will ever se them here.

EMI POLICY

One by one, the other America companies have turned to the 33 1- records, and RCA also, has finall decided to issue them.

All this time, EMI has been sitting pat in England, waiting to se what happened. This company ha been experimenting with ne materials for records for a long tim and has produced some really splendid samples of 78 records on an experimental basis. Furthermore, has improved its recording standar out of all sight in recent times, an the best 78's lack nothing now except those two things—quiet surfaces and long playing.

No one can blame any compan with so much at stake as has EM for being very sure of the ground before embarking on a major chang

To the individual buyer, the chang might well be a new slow-speed o dual-speed motor, a pick-up, an more records. But to the compan which produces the records, it is tremendous undertaking.

NEW STANDARDS

It means the adoption of an entirely new set of standards, a fres set of problems not made any simple by the necessity for great care i processing the finer grooves, an after all this, major changes n doubt, in the mechanical processe of making the record itself.

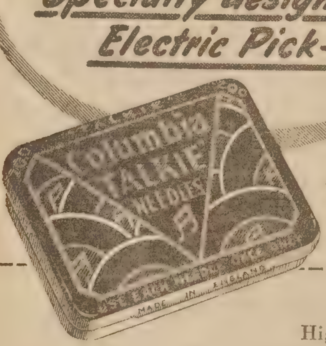
Not only their own future is involved, but to a large extent, th future of the record business in great part of the world.

Added to this is the fact that no all the American micro-grooves hav been good by a long way. In fact some we have heard have been wel below par, either from the start, o because they are susceptible to damage, and require careful handling i they are to last. Vinylite is a ver tricky material to work—it scratche easily, may warp, is susceptible to distortion, and picks up dust like grim death, due to the electrical charge it acquires when subjected to friction.

It may be, that when finally, micro-

"TALKIE" NEEDLES . . .

Specially designed for Electric Pick-ups!



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8 DAYS
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1-day, luminous dial with sweep centre second - hand and dummy time of flight hands.
BRAND NEW.
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SMITH'S, 8-day, non-luminous dial with dummy time of flight hands.
BRAND NEW.
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These WORLD FAMOUS POCKET (ex - Army) WATCHES (as illustrated), with all luminous dials, jewelled movements, with second hand, are worth £8/10/0. Reconditioned as new. A necessity to the man on the land or in the tropics. 65/-
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PICK-UP & PHONO NEEDLES

groove records come into their own, we may have them pressed in something much better.

Reports are that Decca have been making microgroove records in England for some little time, and shipping them for sale to the USA. Now, however, they appear to have taken the plunge, and, as in the case of the extended range records, decided they were good enough to give out to the public in England.

In anticipation of this move, pick-ups and motors have been getting better and better, so that facilities for playing the records should be available at the same time as their release.

REMAKES

What EMI plans to do is still in the dark. Reticence has characterised all their plans in the past, but whatever these plans are, it is absolutely inevitable that sooner or later, long playing records will appear under the famous labels, and when they do, they will be good.

Frankly, I think there will be a big sale for the best of the 78 type recordings remade on the long playing discs. From my observations of pressings made with some of the new materials, many 78 records are far and away better in quality than present record material will allow them to be in fact.

Once he has experienced the uninterrupted playing of a favorite performance, I believe the record buyer will be willing to purchase the same recording made over in the long playing records, apart from the fact already mentioned, that the high frequency range alone should be much more impressive on good machines than it could ever be at present.

MUST WIN

One thing I do believe, and that is that no amount of technical difficulties or other considerations, can prevent the long players from winning out in the long run. Their advantage is so great that it overshadows any other consideration. Record buyers can be resigned to the ultimate introduction of a new record era in which old conceptions will go by the board, and be replaced by others. There probably will be teething troubles, but the game surely has progressed far enough at present for these not to be too severe.

It is impossible to say what Australia's chances are of obtaining long playing records soon. As most of the major releases available at present are imported from England, there should be no reason why Decca's new records cannot be imported also. However, in England, at least, Decca is an independent company, while in Australia, its records are pressed at Homebush. Time alone will tell what progress will be, and, so far, as I have said, reliable reports have reached me only as to what is happening in England.

However, I am one of those who will value greatly good quality, quiet, long playing records, and who expects them in time to entirely supplant 78 records for all major recordings, even if the 78 types still remain for certain applications.

GRAMOPHONE NEEDLES
For the
Connoisseur
pick-up

20 For 6/-

Hard - chromium plated needles with green shanks. Radius of needle point guaranteed accurate to within the tolerance of .002"/.003". Each needle will play 20 sides, and up to 50 without damage to record.
Connoisseur Sapphire Needles .. 13/6 ea.

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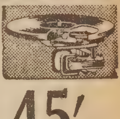
PHONOMOTORS



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PROBLEMS OF HUM AND NOISE

(Continued from Page 37)

fference in hum level was re- ble.

resistance coupled pentode of ype, it is apparently quite per- le to reduce the heater volt- as low as 4.5 volts before any ects become noticeable, apart a lengthening of heating up

t in passing, the reduced heater ; permits voltage amplifier s like the 6J7-G to be operated ut apparent grid current effects grid resistor values as high as egohms.

TER VOLTAGE

ls generally considered inadvis- however, to operate such a with seriously reduced heater ge, if the plate current exceeds lliamp. This reservation would de most triode stages with trans- er coupling or comparatively low es of plate load.

ıother method of heater circuit reduction was used in the pub- ıddress amplifier described last th. In this case the heater supply he preamplifier was duly centre- ed but the return, instead of be- made to earth, was to a positive t in the circuit.

aboratory tests have indicated hum due to heater-cathode ssion can often be reduced or vir- ly eliminated by making the er more positive than the cathode. exact potential difference is not ıcal and it generally works out the most convenient low imped- e positive return is to the cathode uit of the output valve or valves. h ordinary pentodes or tetrodes, will normally lie somewhere ween 10 and 30 volts, which is a te suitable potential for the pur- e.

t is worth noting that a heavy hode bypass, or a directly earthed hode is valuable in many cases, ding to reduce residual hum. (See 4.)

n extreme cases, where all other asures fail to eliminate heater cuit hum, it may be necessary to ovide a d-c supply. This must be atively pure and well filtered, wever, if any useful purpose is to served. The mere provision of a tifier only changes the character the supply, substituting uni-direc- n for bi-directional pulses of cur- ıt.

C SUPPLY

A d-c heater supply is likely to be quired only in elaborate equip- ent. An example was the preampli- r and tone compensating stages scribed some months ago for use ead of the 807 triode amplifier. In is case, the two first valves had 0 milliamp heaters, which were erated in series at the negative d of the high tension supply.

Although, up to this point, the atter of hum has been particularly ressed, circuit noise, in the form of constant hiss, can likewise be a oblem with a preamplifier.

A major source of noise is that enerated by the passage of electrons in the valve itself. Some valves are worse than others but the 6AU6 and, for that matter, other similar high-slope midgets, show up favorably in this respect.

Pentodes are theoretically worse in this respect than triodes due to the random division of current between screen and plate. It is called "partition" noise. In a amplifier of the type used by most enthusiasts, the extra gain from a pentode is generally considered more significant than the noise problem.

In studio equipment, however, where the number of stages is of secondary importance, triodes are generally used for the early stages of the speech amplifiers.

RESISTOR NOISE

Apart from the valves, noise can be introduced by poor quality resistors. In point of fact, every resistor generates noise but some types are much inferior to others. In general, 1-watt resistors are quieter than ½-watt types and insulated types are superior to non-insulated types. However, there are some non-insulated resistors which are very good in this respect. The noise in resistors increases with temperature, so it is wise never to operate a carbon resistor near its maximum ratings if freedom from noise is desired.

A specially interesting article on the characteristics and performance of the miniature 6AU6 as a low level, low noise, triode pre-amplifier was published in Radiotronics Technical Bulletin No. 142 for April, 1950.

The 6AU6 is used as a triode with the plate and suppressor earthed. The screen grid forms the triode plate. This places an earthed contact on either side of the heater and practically eliminates leakage and capacitance effects between the heater and the grid or plate.

With the valve connected as above and with a plate supply voltage of 300 volts, the stage gain is 25 times and the noise level is said to be extremely low.

It is also pointed out that the miniature single-ended valves are better than double-ended types for extremely low level pre-amplifiers because of their smaller electrode structures. The shorter internal and external leads reduce voltages which might be induced in the valve due to the presence of stray magnetic fields.

Though special mention is made of the 6AU6, it would appear likely that other similar miniatures would give equivalent results, if they were treated in the same manner.

Cheese can now be pasterurised by r.f. heating as a result of recent experiments conducted by scientists at Cornell University. The delicious cheddar flavor is best obtained by ageing cheese made from raw milk, and it is much easier to pasteurise ten pounds of cheese than 100 pounds of milk from which it is made.

The experimenters had hoped to be able to treat old cheese with this process, but so far, the radio frequencies pasteurise only very young raw milk cheese. The cheese is placed between two electrodes which carry a high-frequency current. The temperature goes up to 132 deg. F. in about two minutes. This pasteurises the cheese, yet leaves enough enzymes and bacteria to develop flavor.

THE SERVICEMAN WHO TELLS

(Continued from Page 49)

of to say when the said wax-pot is heated on her bright and shiny stove. How can I help it if wax smells?

As a result of this treatment, the oscillator worked when the coil was re-installed but I could tell by the general behavior of the set that the valve was making a poor job of it. A check showed that the 24A was on the way down, and its mate in the detector socket was not much better.

By way of interest, a lot of these old autodyne sets have the same valve—either a 57 or a 24A—in the autodyne and the detector sockets, the detector is generally in better shape than the autodyne because of less onerous working conditions. To keep such a set in operation, it is often necessary to do no more than switch these two valves around in their sockets.

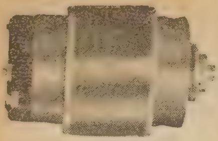
Why I should say these things I don't know. Taking the crust out of my own mouth! But don't try changing all the valves around in their sockets, just for fun. One chap I remember tried swapping around a pair of 45's with the 80, in an old set, and wondered why the 45's didn't seem quite so good after the experiment. To be sure they all had 4-pin bases but the niceties of filament voltage and operating conditions were lost on him.

Coming back to my story, it was clear that a new autodyne valve would be required anyway, but why chase round for another 24A. I had a 57 in stock and a 6-pin socket similar to the 5-pin one already in the set and it was only a few minutes work to change them over and install the 57 as a replacement.

I'm afraid that I still wasn't happy with the result. The set worked but still not as well as it should have done. Having become involved thus far in the matter, I had to get out of it as gracefully as possible.

At that stage I recalled an alternative autodyne circuit which proved, in general, much better than the earlier and popular type. The next quarter of an hour was spent changing it over. Re-alignment was necessary after that, and the stations shifted somewhat on the dial but the darned thing worked, and very well, too.

I cut another notch in the old soldering iron!



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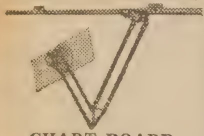

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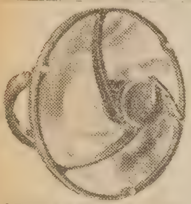

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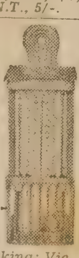

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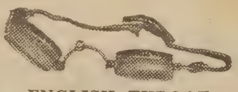

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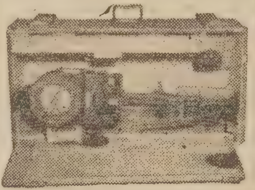

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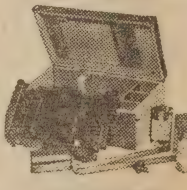

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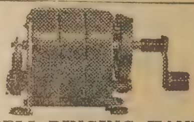

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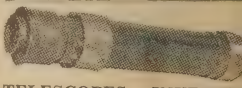

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ANSW[illegible]RS TO CORRESPONDENTS

.C.G. (of Queenst[illegible] Tas.) complains he can only r[illegible]ve three distant one local statio[illegible]t good strength ng the day, ot[illegible] stations being k. He feels t[illegible] he should get e for his mone[illegible]han just four pro- nmes.

While we are naturally not familiar ı reception conditions in your area, are apparently fairly remote from stronger stations and are therefore a similar position to those in the ntry areas of other States. Possibly re may be special factors which render r particular district even worse than ers. If our assumption is correct, cannot expect to receive more than ee or four of the more powerful ions during the day—that is without least a fair background of atmos- eric and set noise. You will naturally eive the A class national stations ter than the B class stations be- ıse the latter generally use much ver power. The erection of a good h aerial may help matters somewhat t even this cannot overcome the prob- n of weak daylight signals. In the ne way, sets may be rather better an others. The problem of weak sig- ls remains fundamentally unchanged. ıu cannot hope to erect any funda- entally resonant aerials, as used for V reception, since the dimensions are cessive on the broadcast band.

G.C.F (of Caloundra, Qld.) writes in preciation of Radio and Hobbies, and plauds in particular, a recent article the "Serviceman," drawing attention faulty electrical fittings. He goes on recount a tale of a recalcitrant 4- lve mantel set.

A. Many thanks for your letter, G.C.F., d we agree that one cannot take too uch care with electrical appliances. our letter has been passed on to the erviceman" for his gentle attention.

D.A. (of Glandore, SA) requests a oklet on superhet alignment procedure d also asks about the lead protruding om the top of an IF transformer.

A. We have forwarded you the pamph- t, D.A., but please note that a charge made for postal replies, also for the rious pamphlets which are available. ıe lead protruding from the top of IF transformer is intended to connect the cap of the IF amplifier valve. here a single-ended valve is used, the id connection is made from the bottom n and the lead can be clipped off ort where it emerges from the can, aving just enough insulation protruding prevent a subsequent short circuit. lternatively, the transformer can be moved from its can in some cases, d the lead clipped off altogether. It simply connected internally to the id connection which is brought out so to the base of the transformer.

I.M. (Clapham, SA) sends in some eries he would like to see answered the "Answer Tom" feature.

A. Your letter has been filed and we ill be happy to deal with it as soon possible.

L.J.M. (Rockhampton, Qld.) says he has btained much help from Radio and obbies and particularly appreciates the fforts of Ray Simpson with the short- ave pages. He has some suggestions to ake about the next handbook.

A. Many thanks for your letter and the ention of Ray Simpson. He certainly oes an excellent job for those who are nterested in logging distant short-wave tations. The handbook has been already et up and your suggestions will have to e held over till next time. It would not e practical, however, to locate the tation lists as you suggest, at least not without seriously compromising the "flow" r presentation of the subject material. f your lists get as "dog-eared" as all that, ou would seem to be an excellent pros- ect for a double sale.

A. T. (West Perth, WA) tells us in a ecent letter of his advances in the field f home radio construction and of his interest in many of the monthly technical articles in the magazine. He asks a question on the Tablegram described in the June, 1949 issue.

A. We are very pleased to note your enthusiasm for the particular articles mentioned such as "The Serviceman Who Tells," "The Junior Experimenter," "Off the Record," etc. We see from your letter that your enthusiasm for technical "meat" has not overshadowed the constructional side of the hobby, and that your advance in experience has been made in logical steps. However, we suggest that your latest idea, that of turning your recently-constructed set into a portable recorder, will require a lot of careful thought and planning. Reference your query on the Tablegram, "Miller effect" will not worry you very much for two reasons. On radio, the sideband cutting due to the selectivity of the circuits, as with any other superhet, is so drastic that the extra treble loss from the audio circuits would be trifling. Furthermore with ordinary speakers, the response is limited anyway to about 6kc, so that, once again, this is much more serious than "Miller effect." The article by the Technical Editor on treble loss was intended to cover high fidelity equipment, where a serious effort is made to apply components and techniques to obtain a range extending to the limits of hearing. That is the time when treble losses of the type discussed become important. You appear to be confused about double-diode variable-mu triodes. The significant classification is "high-mu" triodes—those with a high amplification factor, say 30 or more times.

J.R.J. (Murray Bridge, SA) asks whether we could publish the circuit of a commercial receiver in a forthcoming issue.

A. Sorry, J.R.J., the answer is "no" on two counts. In the first place we do not keep records of commercial circuits in our office. We have job enough filing and districting circuits from past issues of Radio & Hobbies without adding to them the hundreds of circuits used by commercial set manufacturers. The second point is that we do not publish commercial circuits, prefering to leave this to trade magazines as part of their service. Your only hope of obtaining the circuit would be to write direct to the manufacturers, being careful to define the model as clearly as possible.

YOUR QUERY?

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3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
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Readers say:

TREBLE TROUBLE

"I have just read your article on "Treble Trouble In Amplifiers" in R. & H., May, 1950. I was very interested in your tests re capacity in input circuits.

"In your article you mention that the total capacity of a triode is approximately 60 pf; causing bypassing of high frequencies. If this is so, how do you account for the wide range response of the Williamson 807 Triode amplifier, which uses triodes all the way through?"

The figures for input capacitance quoted in the article, are well known and easily substantiated, but the point which you have apparently overlooked, is that they must be related to the total circuit impedance between grid and ground. Our published curves assume an impedance of 1 megohm and relate mainly to the input circuit.

In the case of the Williamson amplifier, the impedance to earth on all grids but the first one, is quite low, being the resultant of the grid resistor, the associated plate resistor and the plate resistance of the preceding stage. The resultant of these is of the order of 10,000 ohms, so that input capacitance effects are not likely to be troublesome, hence the excellent over-all frequency response of the amplifier.

However, the input circuit may easily take the form of a 0.5 or 1 megohm potentiometer, so that the effect of excessive shielded wire and mid-setting of the volume control could be serious. The curve would not be nearly so good as under low impedance input test conditions. (W.N.W., Technical Editor.)

32-VOLT SETS

I have been most interested in the letters sent to you recently by people who have experienced high voltage troubles in 32-volt farm-lighting sets. I was myself concerned for some time in the manufacture of these sets and I can perhaps, offer some observations on the matter.

The basic trouble is that the charging rate of the generator is too great for the battery. Manufacturers of generating equipment usually recommend that the charging rate of the generator should not exceed the rated current of the battery, partly to avoid this trouble of over-voltage, and partly because it is thought, and probably rightly, that charging above this rate shortens the life of the battery.

However, in an effort to supply a cheaper system, many dealers sell generating sets with batteries which are not intended to be capable of supplying more than half the system load, and thus, when the load is light, and the set is charging, the voltage may rise to 39 or 40 volts.

Relays are usually set to cut in at 36-38v. This means that the generators need not have a no-load voltage above 40v, though generators of large capacity usually run at about 50v no-load.

If it were required to charge into too small a battery, a small generator with a low no-load voltage would, of course, adjust itself, as it could not charge at 40v. However, a large generator can overcharge the battery without restraint of the back e.m.f., due to their higher no-load voltage.

A condition of a small battery and large generator is analogous to that of the aircraft system, where the batteries are very small compared with the system requirements, and provide no more than a balancing storage. Here, the voltage is controlled by a regulator; in a farm-lighting set, it is not. A 24-volt aircraft system rises to 28-volts on full charge, and is held there by the regulator. This is equivalent to about 37½-volts on a 32-volt system. But on a 32-volt system, the battery must be big enough to regulate the voltage itself.

There are thus two ways in which an excessive current can be passed into the battery by the generator.

1. Battery the right size for the load; generator too large (to provide "quick charging"). This is easily fixed by cutting resistance into the generator field to reduce its output, or by governing the engine slower. The former is better, as sets are usually governed for optimum engine speed.

2. Battery too small for the load, which is supplied principally from the generator. The only solutions for this are to buy a bigger battery when the present one gives out (as it will before it should), or to charge either without any load which can be effected by over-voltage, or with enough load to hold the voltage to 36-38-volts.

To summarise:—

a. A stationary battery is not like a car battery. As there is no starter, it can have a very long life in the absence of overcharging or overloading.

b. A lighting system is not the same as an aircraft system. There is no voltage regulator and the battery controls the voltage, and supplies at least half of the full load.

c. Batteries should not be charged at a greater current than their normal rate of discharge, if the maximum life is desired. (J. R. Macneil, Hobart, Tas.).

A[illegible]RS TO COR[illegible]NDENTS

N.S.K. (No[illegible] NSW) wishes modify the neg[illegible]ansconductance cillator describ[illegible]the December issue of R & H[illegible]se as a frequen meter.

A. The additio[illegible]a mixer valve a RF input termi[illegible]would enable fi quency measurem[illegible]s to be made. Y could use, say, a [illegible]-G feeding the ou put of the oscill[illegible] to the first gr and the unknown to the signal gr The beat note between the local osc lator and the unknown signal may observed by means of an audio reprodu ing device placed in the plate circu The 150-volt high tension transform you have in mind should be quite sui able. A 6X5-GT rectifier would be good choice. We have not seen the shor wave manual you mention and therefo cannot comment on the receiver. Unle you have any special reason for pr ferring the negative transconductan circuit, you would do better to build th R & H frequency meter described few months ago.

R.R. (Hanwood, via Griffith, NSW asks for some information on an adve tisement which appeared in a back num ber of the magazine.

A. As the content of advertisements not recorded or indexed, R.R., we a unable to assist you. The only solutio possibly, would be to locate someon with a reasonable collection of bac issues and peruse them, letting you memory guide you as to the approxima date.

G.B. (Pascoe Vale, Vic.) has a 5-valv AC/DC receiver to which he wishes add an RF stage and shortwave coil

A. Although what you suggest is po sible, we do not particularly recommen it in your case. AC/DC receivers can very dangerous if not carefully handle by an experienced person, since one sid of the power mains must be directly co nected to the receiver circuits. Furthe the addition of another valve as an R amplifier may disturb the filament ne work which has probably been worke out to suit the requirements of the orig inal number of valves in the set. shortwave converter could be used bu even this would require a special separa power supply to render it independen of the set. We regret that we cann suggest a book which is likely to giv you much help in this matter.

M.F.F. (Erskineville, NSW) is inte ested in the "Tom Thumb" circuit bu would like to try it with a loop aeri as used in the "Tex" baby portable.

A. It is quite likely that the "To Thumb" would work well with the loo aerial but you must understand tha the signal pickup is not nearly so goo as with a large external aerial an earth. You could try the same dimen sions as specified for the "Tex" re ceiver or, if the cabinet is of differen dimensions, wind on approximately th same length of wire. A spot of simp arithmetic beforehand should allow yo to work out the actual figures involve A 100 pf. tuning condenser would n be satisfactory since it would not hav sufficient tuning range. It would prob ably cover only about one-third of th band with an ordinary coil so that ther would be no hope of tuning all th locals in one sweep of the dial.

D.W. (of Rocky Hall, via Bombala wants to know whether the battery ver sion of the "All Band TRF," as de scribed in the August, 1949, issue woul be suitable for "a country listener wireless." If so, could the 1H4-G re place the 1H5 specified.

A. Yes, D.W., the set should give quit good results on the broadcast band, pro vided due care is taken with the coil and adjusment of reaction. It may not b quite as convenient to control as modern superhet and will also lac AVC to counter fading, but you shoul get quite good results from it neverthe less. The 1H4 is really intended t operate with 2 volts on the filament bu our tip is that it will be quite satis factory in this set with a 1.5 vol supply.

ES[illegible]UR KNOWLEDGE OF COILS

[illegible]TH THIS EDUCATIONAL QUIZ

1. "Q Plus" [illegible]nd IF Transformers sometimes use[illegible]e because: (a) It is cheaper. (b) It [illegible] coupling factor. (c) It increases [illegible]or at all frequencies. (d) It increas[illegible]actor at IF and B/C frequencies.

2. Polystyrene tropic-proof varnish is used in "Q Plus" products (a) to keep the wires from short-circuiting to the can. (b) To impregnate against moisture absorption and so prevent loss of "Q" factor and general performance.

3. A more closely coupled No. 2 IF transformer is (a) unnecessary. (b) Improves fidelity. (c) Allows for greater sensitivity when feeding into a diode detector.

4. Special car radio type coils are made by "Q Plus" in order that (a) We will sell more coils. (b) Because the car radio type aerials have a different impedance than the normal aerial and this impedance must be matched to obtain maximum energy transfer, the RF coil must likewise be of different construction to enable it to be aligned with the aerial coil.

5. A progressively wound secondary winding is used in certain "Q Plus" coils because (a) It is quicker to manufacture. (b) It has low distributed capacity and this is a more efficient coil. (c) It looks pretty.

6. The names "Q Plus," "Spheroclad" and "Spherotune" have been announced (a) To distinguish those coils using the special "Carbonyl" Spherical particles in the manufacture of the ferro-magnetic surrounds and tuning cores. (b) As a catch name meaning exactly nothing. (c) To protect the buyers' interests and enable them to see that all the world's latest techniques are brought to them by "Q Plus."

7. The effect of this spherical particle iron dust is to enable the insulating bond to more easily surround each particle, thus insulating more completely one particle from the other, this is important when pressing the material as this is when the insulation can be broken. All this we know improves the eddy current losses, particularly at high frequencies, but this affects the coil (a) By broadening the selectivity curve. (b) It improves the "Q" factor which sharpens the selectivity curve.

8. Increased "Q" and selectivity due to 7 above are important to coil users because (a) An increased "Q" in the aerial and RF coils enables a greater signal noise ratio to be obtained, due to the greater circuit magnification obtained. (b) Will enable greater discrimination in distant reception, provided, of course, that the set is properly aligned.

9. The tuning condenser across an IF transformer (a) Is not critical in value or "Q". (b) Controls the LC ratio of the circuit with corresponding performance. (c) Must be large enough to prevent "Miller" effect and yet small enough to provide a high impedance for the driver valve to work into.

10. Coupling factor is important in coil and IF design because (a) It prevents detuning. (b) It enables the greatest optimum stage gain to be obtained. (c) It can be varied by the user in all coils.

11. The polarity or phrasing of the primary windings. (a) Will not effect the gain in the stage. (b) Have a very marked effect on the stage gain.

12. A top coupling condenser in aerial and RF coils serves (a) To prevent whistles. (b) It helps straighten the sensitivity curve out over the whole band. (c) Helps alignment.

13. Form factor is (a) A term which applies only to portable sets used by bathing beauties. (b) Has no meaning in coils. (c) Is the factor which when used properly enables the greatest possible inductance to be obtained with a given length of wire and thus accordingly the highest "Q" factor.

14. Special oscillator coil design for the many types of converter valves now available is (a) Unnecessary. (b) Is necessary because of the varying oscillator transconductance with each valve.

15. Correct oscillator grid current enables (a) The most gain to be obtained from the converter stage. (b) Is important. (c) Helps battery life in the case of portable sets.

16. Sensitivity of your radio mainly depends on (a) Valves. (b) Coils and IF's. (c) Resistors.

17. Selectivity of your radio mainly depends on (a) Valves. (b) Coils and IF's. (c) The loud speaker.

E FEEL SURE THAT YOU WILL KNOW THE ANSWERS, BUT IF YOU DON'T PLEASE DROP US A LINE.

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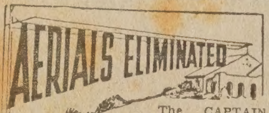

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FOR SALE: 80 copies R. & H. New 1942-1949. 22/6, freight extra. **Jamieson, 33 Kiddingbank Rd., via Cooma.**

SALE: Ed. Comp. special diesel. Frog "175", Petrol "45" aero kit. What offer? **8 Third Ave., Lane Cove, N.S.W. JB3180.**

SALE: Unused, Rola 120 Speaker, O.P.T., suit pair 45's. £2/15/- posted. **R. Oag, Victory Pde., Lisarow, 1N, N.S.W.**

SALE: VK2JU five valve Radio, £9. Must sell. **257 Riley St., City.**

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